Project Report

Development of Effective Water-Management Institutions

A Regional Study Implemented by the
International Water Management Institute

With Financial Support from the Asian Development Bank (RETA 5812)

Final Report, Volume II
Conceptual Framework

30th June 2003

IWMI
International
Water Management
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Foreword

The Terms of Reference agreed upon between the ADB and IWMI in January 1999 stipulated the following specific activities:

i. Development of a conceptual framework for analysis of policies, institutional arrangements, functions and resource mobilization related to agricultural water management in the wider context of integrated water resources management (IWRM).

ii. Case studies in at least two developed countries to identify key elements of successful water-resources management and provide lessons for transfer to the Developing Member Countries (DMCs).

iii. In-depth institutional assessments and performance studies in five participating DMCs to assess the strengths and weaknesses in policies and institutions responsible for agricultural water management, identifying the major issues facing the countries and the opportunities to meet the emerging challenges.

iv. Preparation of action plans and processes in each participating DMC for implementation of institutional, policy and strategic improvements based on the findings of the in-depth assessments.

v. Support for implementation of action plans for policy and institutional reform in the participating DMCs.

The final reporting material of the overall study comprises four components, which are structured in terms of the four main study outputs expected in the TA Agreement, as mentioned above. The four components and the executive summary are presented in five volumes of the Final Report:

Volume I	–	Executive Summary.
Volume II	–	Conceptual Framework.
Volume III	–	Case Studies of Advanced River Basins.
Volume IV	–	Country Studies and Action Plans.
Volume V	–	Towards Water Sector Reforms.

This Volume (II) of the Final Report deals with the conceptual framework underlying the study, the objectives and methodologies of the study, as well as a comment on essential IWRM functions based on study outcomes. The content of this document was used as guidelines by the study team for institutional analysis related to water management in a river basin context.

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Project Leader for the Study

Chapter 1

Introduction

Purpose

This volume of the Final Report presents the conceptual framework behind the study on "Development of Effective Water-Management Institutions." The framework derives from the conceptual basis for the study that emerged from many exchanges of ideas and comments on the original study proposal, and the study framework developed during the inception stage. Based on the original proposal prepared by IWMI, the study document was finalized through a series of correspondence between IWMI and ADB. At that stage, the study was founded on a perceived need to overcome the following key water-related constraints, which hampered economic growth, food security, social equity and human health and well-being in the DMCs:

- Increasing water scarcity.
- Growing levels of water pollution.
- Lack of information on availability and reliability of water resources.
- Sectoral emphasis on water use.
- Bureaucratic indifference towards improving performance.

These five interrelated constraints were seen to be all linked to institutional effectiveness. The study envisaged to explore, from an institutional perspective, how best the effect of these constraints could be minimized in the given contexts.

An initial assumption underlying this study was that sound and sustainable IWRM involved the carrying out of a minimum set of tasks or functions at various levels. IWMI initiated work in 1997 on defining this set of universal tasks with special reference to irrigation-management transfer programs (Frederiksen and Vissia 1998). A more recent study by IWMI developed the conceptual framework further, as part of the outputs of the BMZ-supported study on "Institutional Support Systems for Sustainable Local Management of Irrigation in Water-Short Basins" (IWMI 1997). Meanwhile, ADB had suggested a somewhat related functional approach for "National Water Sector Profiles" (Arriëns et al. 1996, vol. 2, app. A). However, the inception stage of this present study showed that the management of water-resources systems was highly situational, and that providing a minimum set of functions seemed rather normative. Instead of predetermining a minimum set of management tasks, the study proceeded to initially develop a framework for achieving study objectives. As an initial output of the study, the document titled, "A framework for institutional analysis for IWRM in a river basin context" was prepared in early 2000, and distributed among all study partners.[1]

[1]The document was later published as IWMI Working Paper No. 5 (Bandaragoda 2001).

Study Design

The design of the five-country regional study undertaken by IWMI on "Development of Effective Water Management Institutions" provides a new methodology for river basin studies. It consists of four key components of diagnostic investigations related to water resources management in a river basin, which are interrelated. These key components are the physical system, water accounting, socioeconomic situation and performance. An institutional analysis is to be based on these diagnostic investigations. This study design was shared with all members of study teams in the form of the study's Inception Report of 15 June 1999, and the Methodological Guidelines of 1 October 1999 (reproduced in annex 1 of this volume).

Building up on these two documents, a framework was developed to provide a conceptual basis for analyzing the institutional framework for IWRM in a river basin context. The major thrust of this framework is that the four key areas of diagnostic studies in a river basin are shown to be closely linked to the institutional analysis. Using the river basin as the unit of analysis, this conceptual framework seeks to explore the utility of diagnostic studies to develop an effective institutional framework. The diagnostic studies in the river basin help in linking the analysis both to the physical dimension of the water resource, which is related to its location, type, quantity and quality, and to the nonphysical dimension, which is related to its users, stakeholders and their interests, preferences and objectives. In addition, the basin-based diagnostic studies can also link the analysis to the time dimension of the water resource, which are both the historicity and the sustainability related to the use of water in the basin.

Definitional Focus

Based on a simple, but broad, definition of the term "institutions," which has been chosen for this study on the basis of an extensive literature review, the suggested framework for institutional analysis focuses on evaluating three main pillars of institutions, namely, laws, policies and administration. The institutional environment of human actions is seen as a necessary but not a sufficient condition for management performance. Effectiveness of water management institutions, therefore, is seen in their ability to provide an appropriate and adequate structure to human actions involved in water management, a structure that can be used with least transaction costs.

Finally, the document provides a very brief set of guidelines, supported by an outline of some issues, constraints and prospects of institutional change. Particularly, it promotes the idea of developing a contextually appropriate and adequate institutional framework, essentially through a participatory approach involving all stakeholder groups.

Chapter 2

"Institutions," "Organizations" and Management Performance

Need for Clarification

Institutions and organizations are part of our daily life, and the two terms are so common in usage that we have taken them for granted without realizing that they could have some distinct meanings. In analyzing institutional arrangements in any context, a clear understanding of the term "institutions" and how it is related to the term "organizations" is critically important, as many different meanings have been given to this term, depending on where, by whom and for what purpose it is used. A clarification of the two terms and their interaction are given below.

In its most popular usage, the term "institutions" seems to convey a narrow and, therefore, not entirely correct, interpretation. In this erroneous interpretation that is commonly used by many, "institutions" are regarded only as "organizations." The connotation becomes much more common in the use of the term "institution building," which most often refers to the building up of new organizations (parastatal bodies, additional units in existing agencies, farmer organizations, river-basin organizations, etc.).

Often, a preoccupation on organizational development tends to neglect the importance of laws and policies that are necessary for effective organizational performance. This lapse seems to account for the limited success so far achieved in establishing appropriately comprehensive and effective institutional mechanisms for improved water management in many situations. Illustrative of this limited achievement are the new organizational units, On-Farm Water Management Directorates in Pakistan and the Irrigation Management Division in Sri Lanka, which did not achieve desired results for lack of matching legal and policy support to integrate them into the existing institutional framework.

The preferred emphasis on organizational structures and its apparent failure can be compared to an attempt to build and maintain physical structures without due attention to the relevance of operational rules, maintenance specifications, and regulations for allocation of water. Also, some selective organizational reforms are similar to piecemeal and ad-hoc modifications on old buildings with no relation to the conditions and technology under which they were originally constructed.

To avoid developing and installing nominal institutional change, it is necessary to understand the cohesiveness and the functioning of various elements of the existing institutional framework in the contexts under study. It is necessary to distinguish between organizations and their underlying institutions, so that a comprehensive analysis could be undertaken. If there are new performance objectives that relate to changed physical, socioeconomic circumstances, what would be required is a review and reform in both organizational structures and operational rules, evaluated in the context of the wider institutional environment. Initially, therefore, it is useful to clarify the terms "institutions" and "organizations."

"Institutions" Defined

Consider the following list: Caste System, Marriage, Executive Presidency, Contract, The Military, School, Hospital, Trade Union, Labor Laws, The World Bank, Exchange Control, World Trade Organization (WTO), General Agreement on Trade and Tariffs (GATT), International Water Management Institute, Mahaweli Authority Act and the Mahaweli (river basin) Authority of Sri Lanka. One common characteristic of the meanings conveyed by all of these words or terms is that they all serve to shape human interactions. They can all be referred to as institutions, but clearly, only some of them are organizations.

In general sociology, an institution is "an organized, established, procedure" (Jepperson 1991). These procedures are represented as constituent rules of society, or "rules of the game." Primacy of institutions in sociology was seen when Durkheim called sociology the "science of institutions." A commentator on Weber suggested that "the theory of institutions is the sociological counterpart of the theory of competition in economics" (Lachmann 1971, 68). The notion that an institution is a social order or pattern that has attained a certain state or property implies that institutions serve the purpose of shaping and stabilizing human actions.

Institutional economics adopts a similar interpretation in which "institutions" are defined as basically "the rules of the game in a society, or more formally, the humanly devised constraints that shape human action" (North 1990, 3). The institutions set the ground rules for resource use and establish the incentives, information and compulsions that guide economic outcomes.

Institutions can be both formal and informal. Apart from written laws, rules and procedures, informally established procedures, norms, practices and patterns of behavior form part of the institutional framework. After years of tradition, informal practices also become "rules" in their own right, when they are accepted by the society. These formal and informal institutions define and fashion the behavioral roles of individuals and groups in a given context of human interaction, aiming at a specified set of objectives. The key characteristics of institutions are that "they are patterns of norms and behaviors which persist because they are valued and useful" (Merrey 1993).

In many developing societies, informal rules have a tendency to override formal rules, making the enforcement of formal rules very difficult and thereby affecting performance (Bandaragoda and Firdousi 1992). While the coexistence of formal and informal institutions is inevitable, situations where some informal rules tend to contradict formal rules are obviously dysfunctional. Also, it is possible that due to lack of proper enforcement or due to disregard towards the spirit of the written laws, they become ineffective, and are replaced by a set of practices, which show a divergence from the declared laws, rules and regulations. These practices can be referred to as "rules-in-use" (see chap. 5.1).

The emphasis on rules of human conduct in the definition given to "institutions" finds an analogy in the set of rules and conventions governing any competitive sport, such as a game of football. Basically the rules give a structure to the game and provide a basis as to how the game has to be played. The rules also include provisions for rule enforcement including penalties or sanctions for violations and, sometimes, rewards for compliance.

The rules also specify the layout of the playground, the positions of various players and the structure of the team. In this sense, the "institutions" cover both the organization of the team of players, as well as how they should play the game.

Based on the definitions given above and the terminology used in practice, the institutions are a combination of:

- Policies and objectives.
- Laws, rules and regulations.
- Organizations, their bylaws and core values.
- Operational plans and procedures.
- Incentive mechanisms
- Accountability mechanisms.
- Norms, traditions, practices and customs.

"Organizations" Defined

Organizations are defined as "networks of behavioral roles arranged into hierarchies to elicit desired individual behavior and coordinated actions obeying a certain system of rules and procedures" (Cernea 1987). A similar definition describes organizations as "structures of recognized and accepted roles" (Merrey 1993, 8). This hierarchical arrangement is popularly referred to as the "organizational structure." Organizations are groups of individuals with defined roles and bound by some common purpose and some rules and procedures to achieve set objectives. Like institutions, organizations also shape human action.

North (1990, 73) defines organizations as "purposive entities designed by their creators to maximize wealth, income, or other objectives defined by the opportunities afforded by the institutional structure of the society." An example is the Mahaweli Authority of Sri Lanka (MASL), which was created by the government that came to power in 1977. The purpose was to harness water and land resources in the Mahaweli river basin for the much-needed food production and employment generation, two strong political objectives at that time. As its value and usefulness grew in the society, MASL gained acceptance and became an established organization.

For the purpose of our study, institutional analysis at this stage will focus on both the underlying rule systems and the organizations as agents of institutional change. A broad interpretation of the institutional framework as given under "A Broad Definition of Institutions for This Study" will be the chosen approach for this purpose, which will facilitate this needed focus. In order to be able to focus on the suggested emphasis on institutional analysis, an important conceptual consideration is the interaction between institutions and organizations, a brief outline of which is presented below.

Interaction between Institutions and Organizations

Two Perceptions

The link between institutions and organizations can be seen in two ways.

One way is to perceive that how organizations come into existence and how they evolve are fundamentally influenced by the institutional framework. For instance, the creation of Irrigation Departments in many countries followed the enunciation of water-related policy, and the enactment

of Irrigation Ordinances. Similarly, international agreements have given rise to multilateral organizations such as the UN or The World Bank. Thus, the two components, institutions and organizations are intrinsically interlinked, and together, they provide a structure for human interactions. Once established, the organizations in turn influence how the institutional framework develops. For instance, the Irrigation Departments or other water-related organizations some times try to assess changing social, economic, and more importantly, political situations and adjust the institutional framework to suit the emerging demands. Similarly, since the inception of the UN and the World Bank, they have proceeded to expand the institutional framework for the international order.

The second perception of this link is that established organizations, which represent a set of norms and behaviors that persist because they are valued and accepted as useful, are in fact institutions. Irrigation Departments, Water Boards and well-established river basin organizations, such as MASL, are examples. An ad-hoc committee formed for a temporary task is not an institution or a water user association (WUA) formed by government officials for limited purposes during the construction phase of a project. A WUA persisting over time and continuing to fill a need that is valued and useful to its members can be seen as an institution, or an "institutionalized" organization (Merrey 1993, 9).

Either of these perceptions has one important consideration for our study, namely, the need to consider the compatibility between existing laws, customs, policies and organizational arrangements. Also, the value and usefulness of the existing institutional framework as accepted by the stakeholder community need to be evaluated. Changes to make the institutional framework can be formulated only on that basis.

According to both of these perceptions, some established organizations, which are part of the water-related institutional framework can be seen as agents of institutional change. This is a very important consideration in terms of our study. It may be possible to identify the extent to which these organizations have played a role in fashioning the existing institutional framework.

Also, both in conducting institutional analysis and in formulating recommendations for change, the support of such influential organizations can be very useful. More importantly, the real value of these organizations will be during implementation of identified institutional strategies.

Functions of Institutions

The definitions given above highlight that the institutions are humanly devised "constraints" to shape human action. However, the institutions inherently have dual facilities to both constrain and liberate individual and group action (Bromley 1987). A good example is how the laws and the courts system restrict some human actions, and also provide freedom for action in some other instances. Like in the football analogy mentioned earlier, some laws restrict antisocial actions, and some others enable productive actions and protect the innocent citizens.

The dual facilities of institutions are of particular importance in water management. Most water-related rules are meant to constrain the socially undesirable behavior by individuals and groups in the distribution and use of water. Basically, water allocation rules serve this purpose. Some water-related institutions, such as those governing WUAs, are designed to promote organized behavior and equity and provide various opportunities for individual and group advancement, thereby serving to liberate human action.

The institutional framework serves to reduce the uncertainty of human actions, and thereby they have a stabilizing effect on society. For example, established water allocation rules tend to bring about equitable distribution of water, provided that these rules are applied along with other

related rules and norms, such as mechanisms to monitor water delivery system and laws relating to violation of commonly accepted allocation practices.

Institutions that are centrally imposed or externally mandated are particularly meant to bring about stability. Stabilizing effects of institutions can be seen in such instances. For example, many multilateral institutions such as the UN and WTO build on, homogenize and reproduce standard expectations worldwide, thereby stabilizing international order.

Role of Organizations in Effecting Change

The stabilizing effect of institutions mentioned under "Functions of Institutions" does not mean that institutions themselves are not subject to change. As society and its priorities change, institutions (conventions, codes of conduct, and norms of behavior, laws, and contracts) seem to evolve and continually alter the choices available to the individual.

The cyclic phenomenon related to institutions, in which institutions are primarily determined by human action, and once established they in turn determine the scope and character of subsequent human action for desired objectives, is an important consideration in analyzing institutions for possible change. Particularly, the behavioral roles in an organization can surface the need for changes. The analysis should be able to assess whether this need exists, whether it has already been identified, and how an external facilitating role can be useful for identifying and introducing change.

For instance, existing laws and procedures for sharing of water resources among the different users in a river basin may not be adequate in terms of present circumstances. The extent and the character of an observed gap between declared rules and rules-in-use will be a good indicator for institutional change.

An irrigation department established on the basis of an original set of procedures and rules, and the conduct of water users it serves, may demonstrate the need for institutional change. Usually, established organizations and their key members sometimes take the initiative to change the existing institutions on the basis of identified needs, often based on their own interests. This is an important consideration in formulating change.

Institutions and Management Performance

The linkage between institutions and performance is indisputable. But, how institutions contribute to, or affect, performance is important for identifying and assessing the needs for institutional change depending on the current levels of performance.

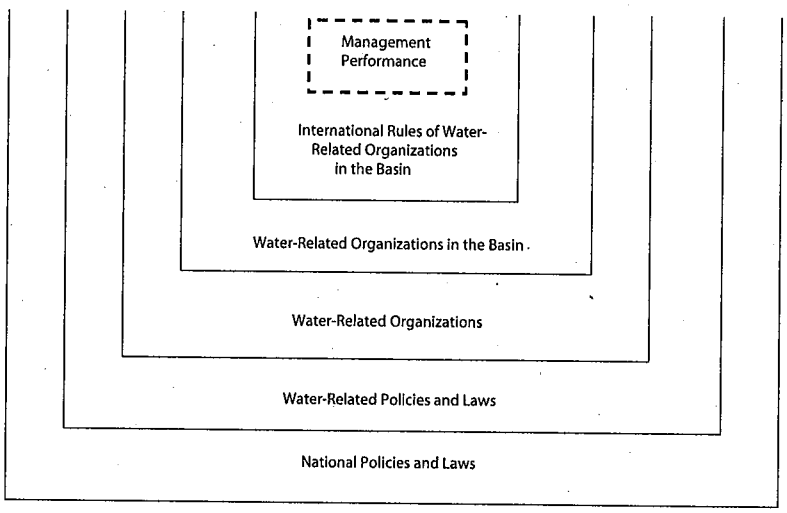
At the outset, it is useful to note that "institutional performance" is a misnomer. Being rules and role structures, practices and norms, institutions do not perform, or effect any performance as such. On the basis of the strength and validity of institutions, it is the management or the people in an organization that actually effect performance. Hence, the emphasis of our sub-title above, "institutions and management performance."

From an economist's viewpoint, basically, institutions affect the performance of an individual, group or organization, a country or its economy, through the effect of institutions on the costs of exchange and production. Together with technology, the institutions determine the transaction and transformation (production) costs (North 1990). Therefore, in a comparative evaluation of two different sets of institutions, performance can be expected to be better in the institutional framework, in which these transaction costs are less.

In institutional analysis, there is an essential need to conceptually differentiate the rules from the players in an organization (North 1990, 4). In the football analogy, while the rules define the way the game has to be played, the objective of the team of players is basically to act according to the rules and win the game. Similarly, the members of an organization have some defined objectives, and they endeavor to achieve them by being within the institutional framework, and using a combination of extra-institutional factors, such as knowledge, skills, strategies and coordination. These factors are related to management functions, which account for performance to a larger extent than the institutions. The institutional framework serves as a necessary condition, but not as a sufficient condition for management performance. A succinct definition by North (1990, 4) aptly refers to institutions as the "framework within which human interaction takes place."

Human actions are constrained and protected by a nested system of different layers of institutions. How management performance is circumscribed by this nested set of institutions is illustrated in figure 1.

Figure 1. Nested institutions and management performance.



A Broad Definition of Institutions for This Study

Based on the discussion in the foregoing, and considering the core meaning of the term "institutions," which emphasizes on the rules aspect, as well as the emphasis in popular usage of the term associated with "organizations," we may use a broad interpretation as given in box 1 for the purpose of our current study. This interpretation covers all three important elements in the institutional framework, namely policies, laws and organizations, and is similar to that adopted by Saleth and Dinar (1999a, b). It is particularly chosen for the study, because it is more easily amenable to institutional analysis aimed at performance improvement.

Box 1. Interpretation of "institutions" adapted for the study.

Based on the abovementioned concepts and definitions, the interpretation that is suggested to be adopted for the purpose of this study is given below.

The institutional framework for water resources management in a river basin context consists of established rules, norms, practices and organizations that provide a structure to human actions related to water management. Notably, the established organizations are to be considered here as a subset of institutions. For practical purposes, the overall institutional framework is considered in three broad categories: policies, laws and administration, all of which are related in some way to water resources management in a river basin context.

Policies	–	National policies
		Local government policies
		Organizational policies
Laws	–	Formal laws, rules and procedures
		Informal rules, norms and practices
		Internal rules of organizations
Administration	–	Organizations at policy level for resources management
		Organizations at implementation level for delivery management

Chapter 3

Integrated Water Resources Management in a River-Basin Context

IWRM

Essentially, the concept of IWRM needs to be linked to the principles enunciated by the Dublin Conference on Water and the Environment (ICWE 1992) and the famous Agenda 21 of the Earth Summit in Rio de Janeiro (UNCED 1992). The main principles and concepts are given in box 2.

Box 2. Dublin principles and key concepts.

Principles

- Water is a finite, vulnerable and essential resource, which should be managed in an integrated manner.
- Water resources development and management should be based on a participatory approach, involving all relevant stakeholders.
- Women play a central role in the provision, management and safeguarding of water.
- Water has an economic value and should be recognized as an economic good, taking into account affordability and equity criteria.

Key Concepts

- IWRM, implying an inter-sectoral approach, representation of all stakeholders, all physical aspects of water resources, and sustainability and environmental considerations.
- Sustainable development: sound socioeconomic development that safeguards the resource base for future generations.
- Emphasis on demand-driven and demand-oriented approaches.
- Decision making at the lowest possible level.

Source: *Savenije and van der Zaag 1998.*

River Basin as the Unit of Analysis

With the recognition of significant reuse of water, the river basin is increasingly acknowledged as the appropriate unit for the analysis and management of water resources, especially as water availability at the basin level becomes the primary constraint to agriculture. Growing scarcity of good-quality water in most river basins results in intense inter-sectoral competition for water. The efficiency of irrigation water use can be seen in a more comprehensive manner, if the allocation of water in a basin among various users is considered along with irrigation use. Similarly, a more

comprehensive analysis requires that the adverse effects of a rapid degradation of the environment and other ecological problems arising from severe competition for water should be studied along with the irrigation-induced environmental problems.

The neglect of such a wider consideration of the resource base has clouded, up to now, the inherent limitations of existing institutional arrangements to deal with irrigation systems. As countries experience growing water scarcity, water sector institutions need to be reoriented to cater to the needs of changing supply-demand and quality-quantity relationships and the emerging realities (Saleth and Dinar 1999a). It is inevitable that irrigated agriculture, the largest water user in many river basins will be called upon to reassess their water requirements in view of the competition of water from other users.

Difficulties imposed by policy and institutional constraints at levels above farms and irrigation systems are attributable to the failure in realizing the full benefits from many reforms that have been attempted in irrigation management. There is now wide acceptance of the necessity to focus on higher-level institutions, generally at the basin level. In Asia, this view was reinforced at regional conferences sponsored by the Asian Development Bank in 1996 (see Arriens et al. 1996).

A basin-level analysis also helps in distinguishing between two important aspects of management: resource management at the macro level, and the service delivery management at the system level. The institutional arrangements for these two aspects of management normally have distinct emphases, and the two sets of functions need to be compatible with each other for optimum level of water use efficiency and productivity.

In terms of institutional change, a basin perspective may bring about a much-needed balance between the need for decentralization and the continued responsibilities of the center. The recent trend has been to focus at the system and farm levels, and look for institutional changes at that level, such as, WUAs to whom part of the system management responsibility was to be transferred. This trend tends to ignore some important areas of management concerns related to the safety of dams, flood control, drought planning, groundwater depletion and environmental regulations (Perry 1999, 49).

In a river basin, there can be a number of issues and problems whose solutions can bring common benefit through good governance, efficient and sustainable resource use and environmental protection and security. These shared concerns can lead to "Communities of Common Concerns," or organized community groups in the basin area. For such groups to become established, one important requirement is an enabling legal environment and a friendly support policy and the law enforcement authorities.

In a genuinely participatory approach, outsiders can play only a facilitating role. Helping the people to help themselves and reach a reasonable degree of stability and strength in community participation is very often a time-consuming process. Their effective participation in resource management, however, depends on the degree of their awareness of important technical considerations.

Some of the ideas expressed in the study Inception Report (15 June 1999), which explained the validity of a river basin perspective, are used here for recapitulation. Besides, they can now be better interpreted in terms of study outcomes realized so far.

On-Site Gains and Off-Site Implications

The river basin as the geographical unit in which analyses are conducted defines an area where various users of the basin's water interact, and where most of them live. A basin perspective helps to include in the analysis the interactions among various types of water uses and water users, and in the process, it helps in understanding better the physical, environmental, social and economic influences that impinge on the productivity of agricultural water management.

In a basin context, interrelated issues on the quantity and quality of surface water and groundwater, and the extraction, use and disposal of water resources can be more comprehensively analyzed. Participation of a larger number of stakeholders can be sought, and water resources planning can be more effectively carried out. The broader view through a river basin is able to capture dimensions which are not normally included in an irrigation system management approach, such as the causes (and not only the effects) of water scarcity, water quality, water-related disputes, and inequitable water distribution and use.

An integrated approach to water resources management in a river basin would enhance both productivity and sustainability of natural resource use. Sustainability means that the concerns on resource use should transcend beyond short-term "on-site" gains, and should necessarily be on an environmentally sensitive use of resources including many possible "off-site" implications. The off-site influences on a water use system, as well as the off-site impacts arising from a water use system, can both be systematically studied in order to identify the factors that affect the performance of the water use system. Figure 2 shows the linkages between these three water-related behavioral patterns in an oversimplified river basin having a single water-use system.

In some of the river basin sites of this study, the complexity inherent in physical and social relationships within a basin has already been surfaced. Development and management practices of a single water use, a single segment of the community, or a single sector take place without much reference to the needs and demands of other uses, people and sectors. Upstream power companies tend to act independently with little regard to downstream agricultural water users. Deforestation in the catchment area of a storage facility disrupts the smooth operation of the facility. Head-end users take more water than necessary, thereby affecting tail-end users in a river system.

Lack of understanding of the interdependencies of various human interventions within a river basin results in inefficient use of resources, economic losses and environmental degradation.

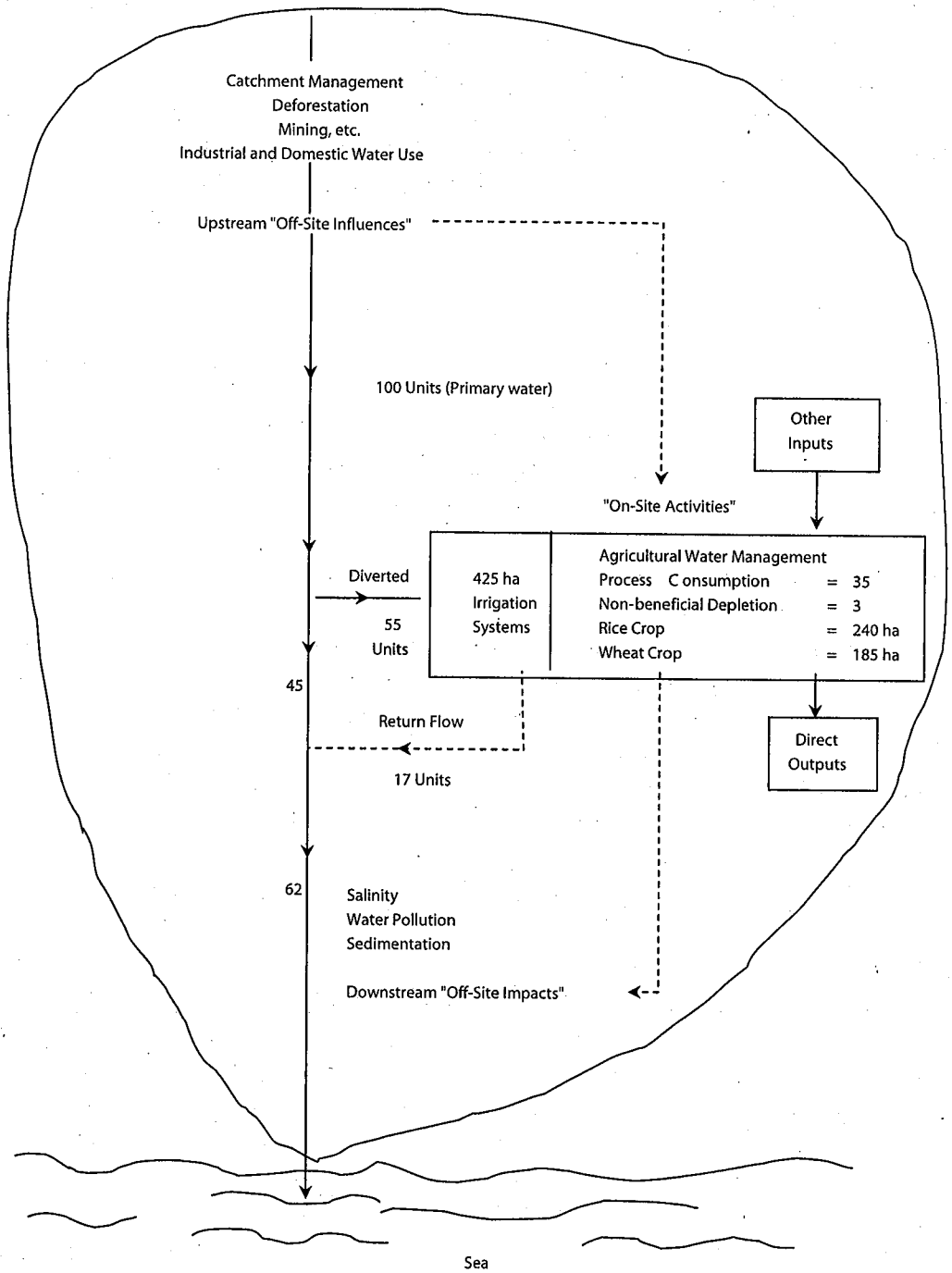
Four Key Elements of the River Basin Perspective

There are some key elements of the river basin approach that may be commonly applicable to all basin locations. Four such key elements, as reflected in the Murray-Darling river basin model (Arriens et al. 1996, 107) are mentioned below.

Appropriate Institutional Arrangements

Water resources are managed and used by multiple groups. Left to themselves, each group tends to give priority to its own needs as coordinating mechanisms do not often exist in a sectoral treatment of water. Considering all users and uses within a river basin facilitates the introduction of such inter-sectoral coordination. Additionally, the stakeholders may collectively derive some synergic benefit from being able to integrate their administrative efforts.

Figure 2. Schematic representation of a river-basin perspective.



In order to derive some significant benefits from an integrated administrative effort, acceptable forms of institutional arrangements (rules and roles) should be in place. The expected behavior by the various stakeholders should be reflected in well-defined rights and responsibilities, as well as in policies, laws and administrative structures and procedures. The stakeholders should be structured through effective organizational and procedural arrangements so that each stakeholder group is aware of its own (and others') rights and responsibilities. The main objective should be to coordinate effective planning and implementation of equitable, efficient and sustainable use of natural resources in the basin with a view to improving the sustainability of its agricultural development.

Reliable Information Base

For effective coordination and institutional performance, water resources management within the basin must be essentially knowledge-driven. As the physical and social characteristics of a river basin system are less-conspicuous than in a more-visible irrigation system, an effective management effort in a river basin should necessarily rely on a sound data base about the physical, social, environmental, economic and institutional parameters of the basin. The different actors and different sectors using land and water resources within the basin should be able to understand and assess the requirements of one another, as well as the limitations imposed on each of them by the overall environmental considerations.

In more practical terms, a basin approach to water resources planning, particularly aimed at assessing the influences on agricultural water management, needs to be based on a number of key sets of information related to the basin, which the study components seek to gather: present conditions of the physical subsystem, availability of water and its quality, analysis of its social subsystem including who uses water for what purposes, how the uses and users have been organized and their binding rules, and the production systems' current performance levels.

Integrated Natural Resources Management in the Basin

In a river basin, a large number of individuals and groups are involved in using land, water and environmental resources for different sectoral purposes. A basin approach in water resources management helps to achieve an optimum level of integration among these various uses of different natural resources. This integration encompasses a coordinated set of policies, rules and regulations covering all natural resources within the basin, and also an effective coordination among the organizations related to the management of all natural resources. For example, the land laws should be in keeping with the laws related to the use of surface water and groundwater, and the laws for environmental protection. A classic case which highlights this particular need for an integrated approach in natural resources management is the traditional rivalry that often exists between agriculture and irrigation functionaries, or the power and agricultural sectors in developing countries. A basin approach to natural resources management facilitates a concerted effort in coordinating the resource use patterns within a river basin.

Strong Community Participation

Much more than in a single-objective irrigation system, the multiple water users with multiple objectives in a river basin require a high degree of coordination in their efforts. The need for

greater coordination calls for greater participation in resource management from all of the water users.

Issues related to local natural resources can usually be identified clearly and more easily by the local community. A long-term association with the basin environment enables local people to gain a very intimate knowledge about the natural phenomena and the related constraints on resource use. Effective community participation leads to an adjustment in the existing power relationships both within and outside the community. Participation brings about empowerment of the people, enabling them to take their own decisions in an agreed framework of rules.

Why Focus on Institutional Framework in a River Basin Study?

To develop strategies for improving agricultural water management, the traditional approach would be to study the irrigation agencies and water management practices. This study not only evaluates other factors relevant to a river basin, but also specifically focuses on water management institutions in a river basin context.

Institutions basically serve as instruments for human cooperation and to reduce uncertainty by establishing a stable structure to human interaction (North 1990). In this sense, the study of institutions related to river basin management is of special significance as the most critical element of IWRM in a river basin is the need for coordination among various human efforts to use the water available within the basin. Therefore, the most fundamental aspect of institutional analysis in the context of river basins is to explore this coordinating role of institutions.

Facilitates Conflict Resolution

In many river basin contexts, conflicts related to water allocation and management exist among geographical units within the basin, among different water use sectors, and among water users themselves within and outside each sector. A significant contribution of a basin-wide organizational mechanism can be towards resolving such conflicts.

A critical constraint against effective river basin management is the commonly prevalent conflict between boundaries of river basins and those of political units. In many instances, the boundary of the political or administrative unit (such as the Nation, Province or District) is the river course itself, whereas in some rare instances, it falls on the mountain ridge. In some other instances, the boundary of the Country, Province or District is a man-made demarcation such as a highway or a fence. In whatever form, when the difference in the boundaries creates a conflict in decision making, invariably the greater emphasis is on the administrative or political boundary. In such instances, a higher-level coordination mechanism is essential, although the effect can sometimes be just nominal, as in the case of the Indus basin (covering a number of provinces within Pakistan), or the Mekong basin (covering a number of nation states). In contrast, a basin which falls within one administrative unit (e.g., Brantas in East Java, Indonesia) has a greater potential for a more smoothly functioning basin management organization.

Boundary conflicts affecting river basin management can get accentuated when they occur in countries involved in political reforms with devolution of power to lower-level units. If the unit of devolution is the District, bypassing the higher-level Province, as it may happen in Indonesia, river basin management is likely to get more complicated due to more complex boundary problems. In such instances, greater care needs to be taken in designing coordination mechanisms.

Although the river basins selected for this study do not involve sharing of water by a number of different nation states, they do cover a number administrative units. Therefore, it is useful to see the parallel between transnational river basin institutions and the mechanisms developed for local-level sharing of water in a river basin falling entirely within one country. As the Dublin Report stated, the institutional arrangements for both should be based on the same principles (ICWE 1992, 40). With the current global trend towards devolution of power to smaller communities, new political units are increasingly being created. As a result, the number of river basins, which need to be shared by two or more political units is increasing. Almost 40 percent of the world's population live in river basins shared by two or more countries (World Water Council 2000, v). The percentage of population living in river basins shared by two or more subnational political units should be much more. Therefore, the need and the potential to establish viable and acceptable institutional mechanisms for shared management of water resources in river basins are vitally important.

Addresses Environmental Concerns

A study of institutions related to the basin would also help in understanding the extent to which water resources management in the basin takes into account the environmental effects of development. Adverse environmental effects go beyond the boundaries of water use sectors and geographical units in the basin. Sectoral institutions usually restrict their attention to their own requirements, and similarly different administrative units usually look after their own interests. The degree of coordination among sectors and geographical units reflects how much environmental concerns are taken into account in the development and management of the river basin. Therefore, one important strategy towards improving environmental protection is to focus on basin-wide institutional mechanisms.

Correspondence to Historical Development

Every drop of water in a river is "liquid history." It traces the path and the process of acquisition, storage, conveyance and its use within the river basin. Many such drops would have flowed in a river from time immemorial. Therefore, how the basin itself has developed in terms of technological and economic advancement would correspond to the institutional framework that has developed over time in a basin. An understanding of the overall development process would help in assessing how, and how much, the institutions have played a coordinating role to promote human cooperation in various water-related activities within the basin.

As institutional development corresponds to historical water resources development in the basin, institutional change tends to reflect the way in which the society and its technology have evolved through time and, therefore, by studying the historical development of a particular river basin we may explore the extent of institutional change that has taken place over time. If the institutional change has been lagging, this may indicate the potential for further change that may be possible and necessary in view of the changes that have occurred in the socioeconomic and technical environment of the basin. At least a short historical sketch of basin development to understand who did what, and for what purpose, in each study site has been recommended for this purpose.

Institutional Environment of a River Basin

Five main external factors can be identified as either constraints or enabling situations that affect the water management institutions in a river basin. These external influences are the overall political system, national economic policies, legal framework, socioeconomic environment and the physical resource base.

For instance, the overall national policies play a significant role in fashioning the institutional framework for any given social context. Box 3 relates a story on how a broad policy could affect a simple rule related to water management. It also shows how it tends to be circumvented by other economic policies in the same country.

Box 3. Effect of overall policy environment.

Before Energy Policy Act in 1992, most toilets used 3.5 gallons of water per flush. After 1994, when regulations were first enforced, toilets were limited to 1.6 gallons per flush.

Comparing total water use:
Homes with 3.5-gallon-flush toilets used 20 gallons for the toilet, and 73 gallons daily. Homes with 1.6-gallon-flush toilets used 10 gallons for the toilet, and 50 gallons daily.

Although US law prohibits the production of toilets that use more than 1.6 gallons of water per flush, there is a loophole. American manufacturers can still make high-flush toilets for sale outside the USA. Americans legally buy and import them!

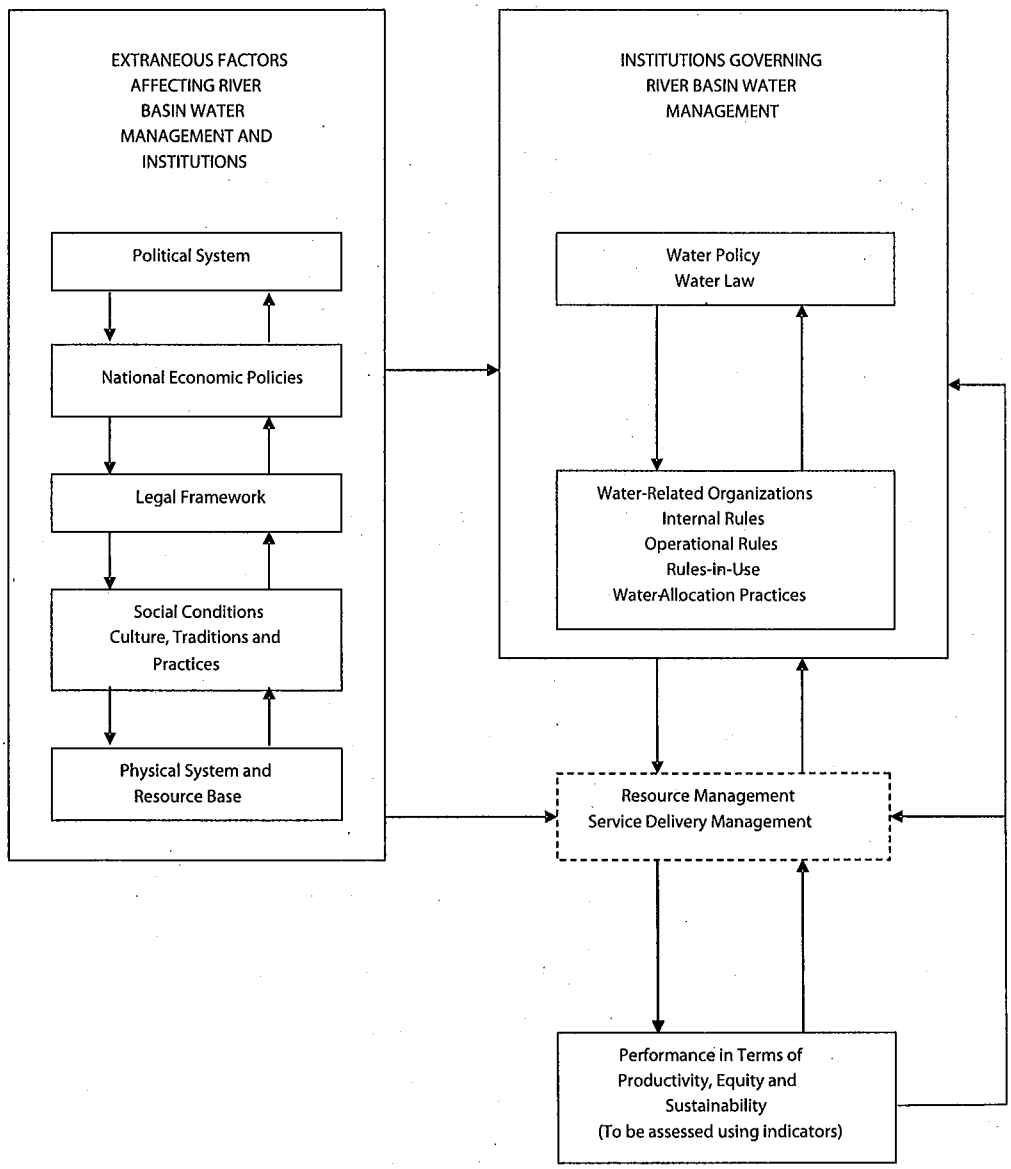
Source: Research by Hillary Wasson, reported in USA Today of 2 June 2000.

Similarly, the overall legal framework and the general "law and order" situation in a country, particularly the social conditions that determine how the laws and rules are applied and adjudicated have a significant effect on water management institutions.

In some instances, the culture, traditions and practices inhibit the effective functioning of water management institutions, whereas, in some other instances, they tend to promote them. In order to asses the actual impact of these external influences, it is useful to have an understanding about the social conditions, traditions and practices in the given context.

Figure 3 shows the conceptual framework underlying the water-related institutions in a river basin.

Figure 3. Institutional environment of a river basin.



Chapter 4

Study Components Leading to Institutional Analysis

Study Design for Institutional Assessment

As highlighted under "Study Deign," the main objective of country-based studies is basically twofold. First, the field studies in the five countries are expected to identify the relationships between physical and socioeconomic characteristics of selected river basins[2] and their existing institutional arrangements. Second, based on this diagnostic information, possible institutional changes were to be identified for improving the management of water available for agriculture in the context of IWRM in river basins.

In the Methodological Guidelines, six key research questions were mentioned as relevant in a search for appropriate institutional strategies in given contexts:

- What is the hydrological resource endowment of the river basin?
- Who are the present users of water, and what are the present patterns of water use differentiated by sector, public and private uses, gender and income level?
- What are the formal and informal institutional arrangements for sharing water between uses within the basin and what provisions (or potential) exist for satisfying the unmet water needs of disadvantaged groups, such as women, children and the poor?
- How do the present formal and informal arrangements for allocating and managing water between uses affect equity and productivity of agricultural water use within the river basin?
- What is the nature of conflicts between uses and the means for conflict resolution within the basin?
- What can we say about the future trends and scenarios, with special reference to the future of irrigated agriculture and access to water resources by poor women and men?

Considering the river basin as the unit of analysis places emphasis of research at a plane higher than that of the traditional irrigation system management focus and facilitates the concerns to shift towards overall water policy and IWRM. This ideological stance helps to capture the effects of growing inter-sectoral competition for increasingly scarce water resources.

The country studies aim to assess the degree of their temporal and spatial scarcity of water and competition from all the water use sectors, and actively participate in finding solutions to

[2]Although, a river basin is typically defined as the entire geographical area from which water drains to the point at which the river flows to a sink (i.e., the sea), for purposes of this study, this definition was adapted to mean the entirety of such a river basin or a part of a basin (subbasin) defined by the location of its stakeholders who have an interest in one or more particular water management problems and who have the ability to address them.

improve agricultural water management. The study design also enables the important research and policy considerations on water quality, resource depletion and degradation and the environment.

The collaborative study activities in the five selected countries are aimed at improving the management of their scarce water supplies for sustainable agriculture, within the constraints of competition for water by other sectors and water-use related environmental problems. The physical and social diagnostic analyses will help in evaluating the existing institutional framework, as well as in formulating institutional change. The diagnostic analysis on irrigated agriculture performance will help the development and initiation of appropriate action plans to address the identified constraints against agricultural water management.

The five countries are in varying degrees of water resources development and related institutional development. They are also at different levels of water management performance. The country studies will identify the distinct features in each of the selected water basins in the five countries, and assess the issues and constraints in the context of their respective national and regional water policies. The studies in the five countries will also add to the institutional reform processes already launched in some of these countries, and will provide an impetus for reform in the others. The studies will also contribute to the Bank's initiatives in promoting national water policies.

Although the five study components are separate activities, they are all related to socioeconomic relationships of the stakeholders associated with the basin's water resources. To this extent, the components are interrelated and, in turn, are linked to the final study goal of improving the productivity of agricultural water management in the basin (see figure 4). The usefulness of studying contextual factors in each selected river basin for a final institutional analysis is further explained in the following four sections.

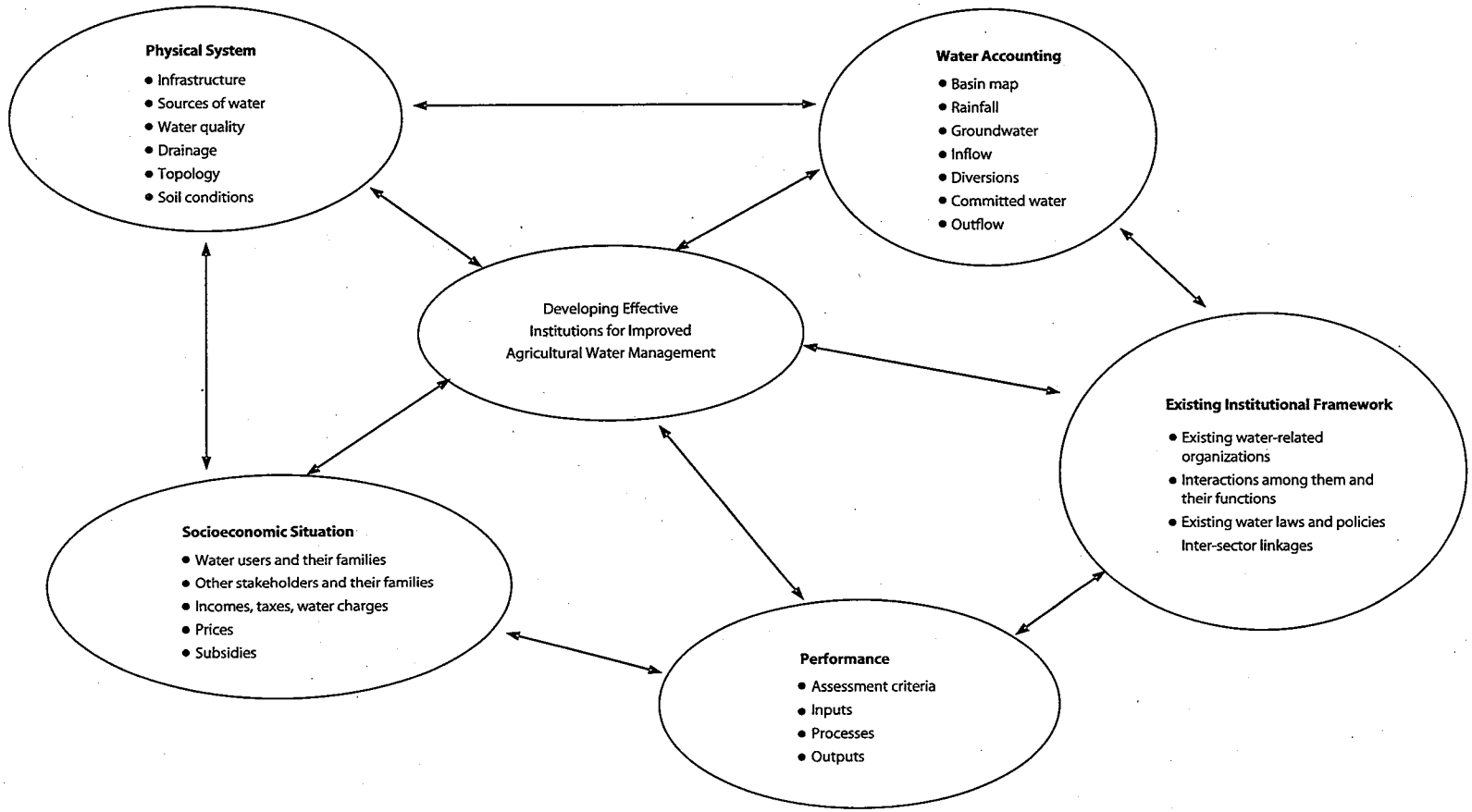
Physical System and Institutions

Presenting a river basin perspective for water development, G. F. White (1957) once noted that "if there is any conclusion that springs from a comparative study of river systems, it is that no two are the same."

The topology, soil conditions, climate and rainfall, geographical location and natural vegetation all combine to distinguish one river basin from another. Closely related to these natural features are the man-made infrastructures for harnessing water resources from the river system to develop natural resources within the basin. In addition to the natural features of the basin, the characteristics of infrastructure, such as size and scale, technology and purpose tend to determine the type and character of institutions established for water resources management. In effect, the physical system of the river basin mirrors the institutional arrangements.

A good illustration of this relationship is the canal irrigation system in the Indus basin and its institutional arrangement for water management. The flat terrain of the basin makes storage difficult and requires that the system is a run-of-the-river diversion in a contiguous canal system. At the tertiary level, there is continuous water flow along the watercourses and the structure at the head of the watercourse is so designed to allow for automatic proportional distribution of water into the watercourses. This physical system is matched by a water allocation system in the form of a time-turn based rotation, popularly known as *warabandi,* which is self-policing and meant to share water scarcity equally among all the water users in the watercourse command area. Basically, the system is geared for minimum management and control, which also reflects the need to cater to a

Figure 4. Study components aimed at developing institutions for improved agricultural water management in a river-basin context.



system of very long canals and a vast command area. Also, it reflects the social and economic characteristics of the water user community.

Water Accounting and Institutional Analysis

If a river basin is defined as the entire geographical area from which water drains to the point at which the river flows to a sink (lake or sea), then, the amount of water in a given river basin in typical years should be a constant. The only exception would be if there are man-made facilities for interbasin transfers of water. Historically, therefore, the variable phenomenon within a river basin is the water use through human interventions. As mentioned earlier, as the population increases, and as the technology and social behavior change over time, the pattern of water use also changes. The main purpose of the water accounting activity is to assess this pattern of water use at a given point of time, and over a period of time. Water accounting is something more than calculating a water balance. Simply, it is accounting for water resources in the river basin, to understand how much water is approximately received by the basin, and how, how much and for what purposes this amount of water is used. The proportion of water that is (purposively) used for beneficial purposes directly corresponds to the intensity and efficacy of water management institutions, and the nature of this water use corresponds to the character and quality of the institutions.

Socioeconomic Situation and Institutions

As the population increases, interregional migration and rate of urbanization also tend to increase. In a consumer-oriented society, competitive demands for water for various purposes in a river basin (industries, drinking and domestic, and environmental protection) gradually increase. These increased demands are bound to clash with the traditional interests of agricultural water use, and related institutions. The process of urbanization and modernization (development) accompanies new technologies, and they in turn cause social change. Together, these socio-technical changes call for changes in the existing institutions.

A good example is how the traditional water allocation principle of "prior appropriation," as in the Colorado State in USA (Moore et al. 1994), has been threatened by the new demands for water, accompanied by some technical innovations. Remote data collection through telemetry networks and automated control systems provide managers with "real-time" information about water supply and demand and help them to fine-tune their methods of using water efficiently. As part of this technological advancement, "demand-tailored" water deliveries are possible, and the result is a tendency towards developing new agreements to reapportion surplus water. At the same time, other nontraditional water uses, such as power, municipal and industrial supply, flood control, navigation, fish and wildlife, and recreation purposes press for their water rights through various lobbies and legal instruments. State laws are supplemented by Federal laws and Supreme Court decisions. For instance, the preservation of minimum stream flows is now part of the "public trust" doctrine of USA. The term, "beneficial use" is being defined as the "greatest good for the greatest number." Another strange form of flexibility is emerging as a result of "parallelism and conflicts in laws." The point is that a change from the traditional "first user—first right" to a new

institutional framework is now possible because of innovative technological support to use water more efficiently, and the accompanying changes in social attitudes towards sharing of water.

The lesson that can be learnt from this experience is that there is a need to understand in any context the changes (or the potential for change) in terms of the technology of water management and the related social change that may have occurred in the recent past. This understanding will help in determining the extent of change that can be incorporated into the existing institutional framework for water management.

Experience in the Omonogawa river basin in Japan provides another example of how new technology has combined with the existing institutional framework to solve a recurrent problem. Using the tradition of Land Improvement Districts, which was sufficiently adaptable, new technology was deployed to develop the basin with diverted water from the river through new canal systems. This basin development has played a significant role in reducing the frequency and the effect of droughts and floods in the area. Storage of diverted water serves to regulate flows and make water available on a more uniform basis throughout the basin. New technology has added automated control systems to the traditional LID procedures for better water resources management.

Performance Assessment and Institutional Analysis

The study component on performance assessment is designed to be limited to irrigated agriculture within the selected river basin. This decision was taken at the inception of the study, so that the available study resources would be best spent by focusing on the basin-wide influences on the major water use and the productivity of agricultural water management. Although this strategy agrees with the Terms of Reference of the study as well, the study is still designed to assess the need for coordination mechanisms in the institutional framework that would eventually contribute to improved productivity of agricultural water management.

Once the current performance levels of irrigated agriculture are assessed (following the indicators given in the Methodological Guidelines), the influences of the existing institutional arrangements on the production processes are to be identified.

As explained above in section under "Institutions and Management Performance," the study design considers that the institutional framework is a necessary condition for entrepreneurs or members of an organization to perform in the pursuit of their objectives subject to leadership and coordination provided by the management. So far as this document has presented, its main focus is on the institutional arrangements, and stops short of proceeding to assess the efficiency of management functions. The main task at this stage of the study is to evaluate whether the existing institutional framework negatively constrains the performance of management tasks.

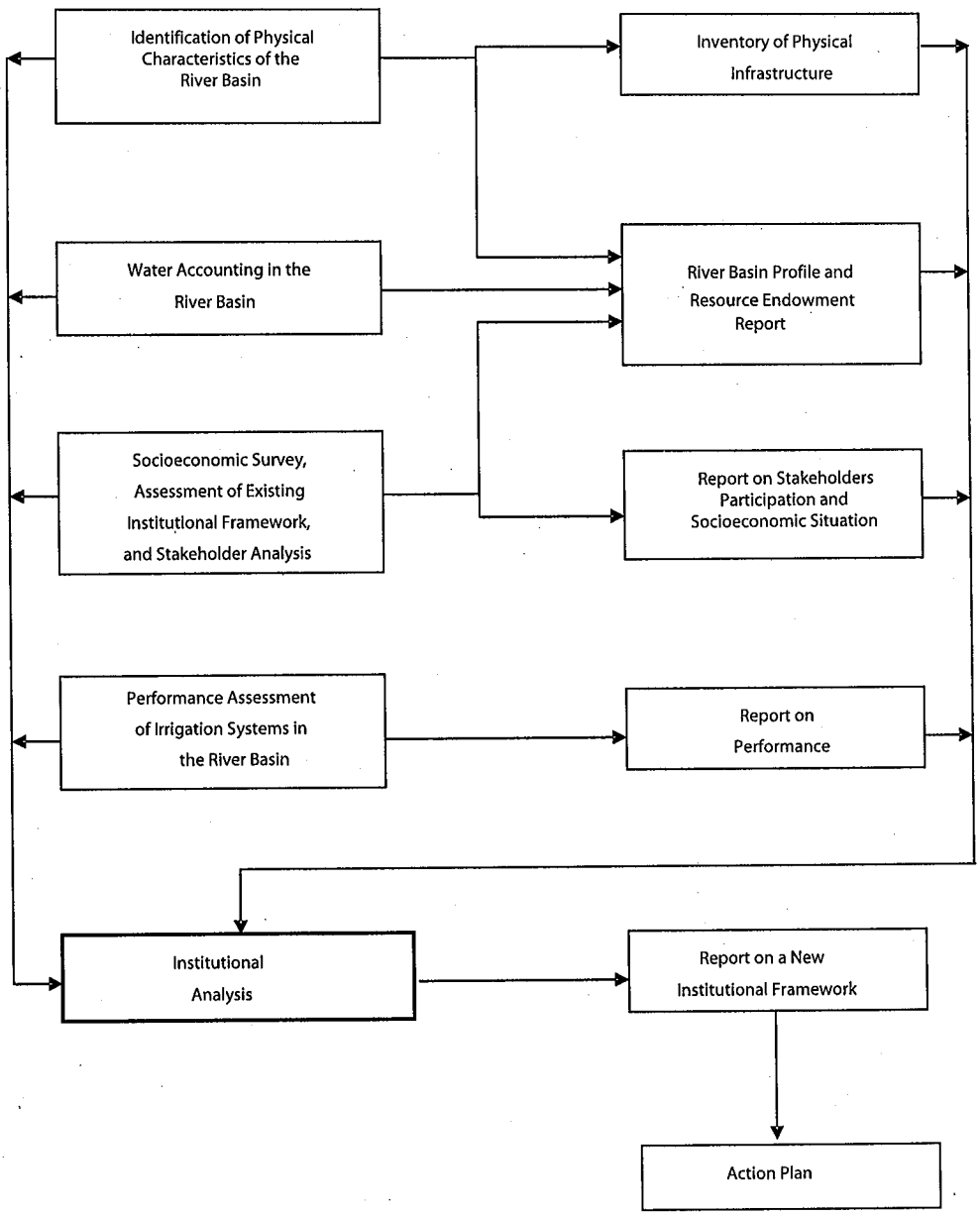
Institutional Analysis for an Action Plan

In the process of studying these different aspects, the study groups have an opportunity to understand the site-specific and country-specific institutional environments and their influence in developing and implementing new institutional strategies aimed at improved agricultural water management. As the study progresses, the study teams are expected to develop draft reports on

these components. The linkages between these various contextual aspects and their study outputs, including how they are all leading to a final institutional analysis and a related action plan are shown in figure 5.

In sum, the diagnostic phase of the study provides an appreciation of the whole river basin, its physical and socioeconomic characteristics and its current performance levels. Along with these aspects, all forms of institutions related to water resources development and management within the selected river basin are identified. Performance of the management system should be assessed in relation to this existing institutional framework. Subsequently, once areas for performance improvement and the scope of possible improvements are identified, institutional analysis can be carried out to identify improvements to be effected to the existing institutional framework.

Figure 5. Main study activities and outputs.



Chapter 5

Formulating Institutional Change Strategies

It is useful for us to appreciate some important issues and constraints related to institutional change. Such an appreciation would help the analysts to identify the effects of these issues and constraints in the given context, and explore how best the constraints can be overcome in an attempt to formulate and introduce change.

"Rules-in-Use"

In analyzing the institutional framework, it is useful to realize that declared rules, or formal institutions, can change in character in their actual use in the given context. Forces of tradition, such as feudalism, caste and kinship have a greater influence over people's lives than the written codes of law. The difference between declared rules and rules-in-use is an important consideration for evaluating institutional arrangements for water management, which is a field in which social relationships play a significant role. In fact, some analysts of irrigation institutions have defined institutions as the "rules-in-use" (Ostrom 1992), as they are more commonly acceptable than the declared rules.

Depending on the socioeconomic context, the formal institutions designed to govern human conduct in an orderly manner can give way to a flexible and adjustable set of rules. For instance, a recent study in a sample of 22 watercourses in Pakistan's Punjab did not find a single official warabandi water allocation schedule in practice as originally designed (Bandaragoda and Rehman 1995).

The importance of understanding rules-in-use as against declared rules in water management lies in the complex nature of the rural society itself, which is closely associated with water management. For example, farmers are not a homogeneous group. Different groups of farmers (large, small, rich, poor) have different sets of goals and objectives, and different alliances. The value attached to formal rules by this heterogeneous group depends on their varying objectives and backgrounds, and over time, the rule-in-use becomes what the majority has modified and accepted.

Rule Enforcement

In terms of transaction cost theory, the functioning of institutions depends on the costliness of enforcement (North 1990, 4). The gap between the declared rules and the rules-in-use is also basically a result of the laxity in rule application and enforcement, which may well be due to the higher cost of enforcement. Therefore, in institutional analysis, there is a need to look into the enforceability of existing formal rules. Based on such information, consideration can be given to enforcement and related costs in the formulation of new institutions.

Role of the Elite in Institutional Development

Some analysts attach considerable value to power and politics in establishing, maintaining and changing institutions. For instance, Arthur Stinchcombe in his book Constructing Social Theories defined an institution as "a structure in which powerful people are committed to some value or interest" (Powell and DiMaggio 1991, 191).

Normally, in many countries, policies, and institutions based on them, are established by the influence of a few elite, either among professionals, or among powerful political leaders, or of a combination of both. Once established, the institutional framework becomes useful for maintaining or expanding their power base, or perpetuating their interests. Classic examples are from the international order, the power implications of the UN system or other similar multilateral institutional arrangements like GATT or World Trade Organization. Much less visible examples are plenty in national political and administrative arena in any country, including the way the political parties are established and developed, and how resource allocation is effected.

Lobby groups are invariably related to the various power blocks, which bring to bear their influence in creating the so-called "public opinion." Imposition and releasing of many forms of control or concession stem from some interest group or other. Who eventually succeeds in establishing norms or practices would depend on which group has greater political power. The validity of this argument is very much relevant to our efforts in analyzing and developing effective water management institutions within a river basin.

The analysis should therefore essentially explore the role of influential persons and groups in shaping the existing institutional framework, by exploring the possible power implications of its existence. This knowledge would help in taking due care to ensure that more democratic and participatory approaches are deployed to reduce inequity in future action plans.

With this reality in view, at least an awareness can be built to help in formulating practical and realistic modifications to the existing institutions.

Difficulty in Effecting Institutional Change

Despite the dynamic nature of institutions, purposively effecting institutional change is not easy. The main reason for this difficulty is the stability of well-established institutions, which are in equilibrium at any given point of time.

Various institutional components are intrinsically interlinked; like planets and stars in a solar system, they are in some dynamic form of balance or equilibrium. Policies on agriculture and water including those on subsidies, trade, rural industries and land reform; the legal system covering land and water resources management; and various organizations set up to implement project and programs are some of these interlinked institutional elements. In the context of water resources management for agriculture, these linkages are crossing the boundaries of various categories and groups of people, adding to the complexity. For instance, some farmers are more closely linked with agency staff than with the farming community; people shift their political alliances when their leaders change parties. Politicians from rural electorates may have an urban bias in their policy preferences.

Thus, a particular element of institutions is so deeply embedded in a network of such similar elements and networks of relationships that an intended change in one institutional element involves corresponding reactions from other elements in the network. This difficulty of change inherent in

institutions explains why some institutions remain in practice or in the statute book, despite its obsolescence or its counterproductive nature.

Rules-in-Use are more difficult to change. A case in point is the difficulty in changing a particular cropping pattern or calendar that has been in practice for some time. While formal rules on equitable water allocation may exist in the rule book, farmers may have been accustomed to flexible water distribution. Dislodging a well-established practice such as free riding by the head-end water users in a canal system has not been proved easy in many places. To change them by a mere regulation or new structure is simply impossible. A greater chance of a change may exist if the change covers a wider area of practices, procedures or structures, such as those meant for water measurement, water delivery, equitable distribution of water, and even broader policy areas aimed at the distribution of productive assets and ensuring accountability.

Similarly, it is equally difficult to introduce some useful institutional element even if the majority accepts it. The major reason for this is the cost of introducing change through a multitude of agencies and their procedures. In either of these cases, two countervailing forces act against change in the existing institutional framework. One is the common interconnectedness of many institutional elements, some of which may have substantial value to the society at large that the overall cost of a change is more than its apparent "direct" cost. The other is the procedural constraints in the introduction of change, including the popularly known "resistance to change" (even to change the name of an established organization is much more difficult than usually expected).

Both these aspects coincide in what North (1990, chap. 4) describes as "transaction costs" of exchange, the key to which is presented as the costliness of information, and processing information. The daunting aspect of this explanation is that transaction costs are increasing; within a century, the proportion of the US national economy devoted to transacting has increased from 25 percent to 45 percent. Many other countries may have similar experience in escalating transaction costs.

Institutions typically change incrementally rather than in a discontinuous fashion (North 1990, 6). Even if some quick change is anticipated by a new policy or law, it is fairly common that the society adopts it slowly. The main reason for this incremental change is that there are many institutional elements which are interconnected, and a change gets cushioned by many other established institutional elements.

Replicability of Success Stories

The design of the regional study presupposes that lessons can be learnt from developed country experiences of successful institutional development. With this possibility in view, the study proceeds to develop case studies of advanced river basins. However, attempts at replication or transplanting of institutional models have not been very successful in some of the countries under study (e.g., Sri Lanka, Philippines). It is therefore useful to understand whether there are special conditions under which such attempts could be successful. There is a need to analyze the local situations in that light to explore whether they could absorb some identified lessons from elsewhere, to make the local institutional framework more effective in achieving improved IWRM within river basins.

Experience suggests that transfer of institutional models is not easy. Hunt (1999) found in an analysis of conditions in Australia and neighboring Solomon Islands that "direct transposition of

the 'user pays' policy was not sustainably viable." His analysis included a number of contextual factors that seemed to sharply vary in effect in the two contexts: political structure, stability of national priorities, living standards, technical-development levels, literacy levels, financial management and infrastructural-development levels. More importantly, change management in the developing countries was seen as so volatile that a developed country policy or institutional model would not have a chance of gaining root in an extreme instance of change management.

A similar study involving the possibility of transferring the river basin management model in Australia to Vietnam concluded that the hydrological and socioeconomic contexts would be the major determinant of the transferability (Malano et al. 1996). While general principles of good allocation and rational water resources management are transferable from one context to another, no package or formula in doing so is viable. This study also found that even in Australia, the two political units, New South Wales and Victoria had two different paths of institutional development, though within the same Murray-Darling river basin, implying that local-level conditions and initiatives for change are vital in establishing new policies and institutions for water resources management. A study of the socioeconomic and hydrological context in a given river basin is, therefore, essential to identify the suitable strategies for absorbing even general principles from other situations.

However, despite the contextual differences in river basins, White (1977) has acknowledged that developing countries, which have special problems of water management, should be able to "profit from the lessons learned in the nations which have made heavier investments in engineering work." In a more recent study of comparing river basin development experiences in the Mississippi and the Mekong, the conclusion was that both these large basins were having the same challenge of sustaining the ecological integrity of the basin, and that Mekong could learn some lessons from the Mississippi's longer development experience (Jacobs 1999).

Participatory Approach to Institutional Change

Institutional Adaptation

In view of difficulties in the transposition of institutional models from one context to another, the suggested approach is "institutional adaptation." This method assumes that the contextual factors assessed during the initial diagnostic phase of the study would form the foundation for analyzing the necessary institutional arrangements for improving agricultural water management in the context of IWRM within the selected river basin. The method also assumes that a participatory approach involving all of the stakeholder groups through a series of consultation meetings would be the best way of developing appropriate institutional strategies. The outcome of these interventions would be an adaptation of the existing institutional framework to accommodate the identified needs for improvement, rather than the total transposition of an institutional framework that exists, and works well, elsewhere. Lessons from success stories elsewhere will only be used in the needs identification, which too is to be collectively effected by the local stakeholder groups.

Value of Stakeholder Participation

The advantage of participation by user groups and other stakeholders would be the facility in identifying appropriate institutional measures for effectively attending to a number of resource management needs: arresting free-rider behavior among the members, mobilizing the needed financial and labor resources, imposing sanctions on individual members for resource degradation, providing incentives for resource saving, interacting with the government and other individuals and organizations such as suppliers, contractors and purchasers of produce, and developing and implementing group decisions for equitable resource distribution and environmental protection.

Role of Facilitators

With this suggested approach, the value of research and expert advice becomes an issue. To what extent can research guide a group of stakeholders in policy-oriented decisions? An apt reply came in the form of recommendations at the end of the UNESCO World Conference on Science, the main thrust being that public participation would certainly serve to extract the best of lessons and advice (see box 4).

Box 4. Declaration of the International Conference on Participatory Processes in Water Management (PPWM) – Satellite Conference to UNESCO's World Conference on Science, Budapest, Hungary, June 1999.

"Science is a necessary but insufficient basis for public policy decisions. Science informs policy decisions by providing the factual basis upon which decisions can be made, and alerts decision makers to the degrees of certainty or uncertainty associated with these facts. But decisions about public policy inevitably involve choices among competing visions of the kinds of societies in which we want to live.

"Public participation is a precondition for social acceptance of public policy decisions. Public participation informs public policy decisions with the goals and aspirations of those people who believe themselves or their societies to be affected by these decisions. Participation is a process of mutual education amongst the public, scientists, and decision makers about public concerns, the factual basis for the decision, and the process of decision making itself. The transparency of the process deepens the trust between the public and policymakers, and also the trust between the public and the scientific community.

"Public participation must meet the following requirements before it will ensure legitimacy and credibility for science decisions:

1. The public should have a say in decisions about actions that affect their lives;
2. Public participation includes the promise that the public's contribution will influence the decision;
3. The public participation process is effective if it a) actively seeks out and facilitates the involvement of those potentially affected at all levels of society, b) provides participants with the information they need to participate meaningfully, c) creates a forum for discourse and interaction with others who are potentially affected, with the scientific community and policy decision makers.

"Public participation is a catalyst for more responsive governance. The conference concluded that public participation is an essential precursor for sustainability of both the environment and civil society."

Source: Water International 24 (3): 277-278. (September 1999)

In a genuinely participatory approach, outsiders can play only a facilitating role. Helping the people to help themselves and reach a reasonable degree of stability and strength in community participation is very often a time-consuming process. Their effective participation in resource management, however, depends on the degree of their awareness of important technical considerations. Social organization to establish manageable groups within the community helps not only in bringing about this required awareness through various capacity building measures, but also in developing capability for collective action through effective participation.

A facilitating role by experts will also include capacity building among the stakeholder groups to understand and appreciate the main principles of IWRM in the context of a river basin, and the capability for performing essential management tasks.

Chapter 6

Guidelines for Institutional Analysis

This chapter outlines some guidelines for proceeding to institutional analysis based on the foregoing. Particularly, the conceptual background on institutions, organizations and management performance outlined in chapter 2 and the river basin perspective of IWRM outlined in chapter 3, and the chosen definition of institutions referred to under "A Broad Definition of Institutions for This Study" will form the basis of these brief guidelines.

Analysis of diagnostic study components given in chapter 4 and the hints for institutional change outlined in chapter 5 are meant to supplement these guidelines.

Main Components of Water Institutions

The definition adopted for our study is given in box 1 under the section on "A Broad Definition of Institutions for This Study" of this document. Accordingly, following the analysis of Saleth and Dinar (1999a, b), the water management institutions are categorized into three main components: water policies, water laws, and water administration. These three main components include most of the institutional aspects referred to in chapter 2. The categorization of key elements are as given in box 5, which is adapted from Saleth and Dinar 1999b.

Box 5. Water-related institutions.

Water Law

- Legal coverage of water and related resources
- Water rights
- Provisions for conflict resolution
- Provisions for accountability
- Scope for public-/private-sector participation
- Centralized regulatory mechanisms
- Integration of overall legal framework with water law

Water Policy

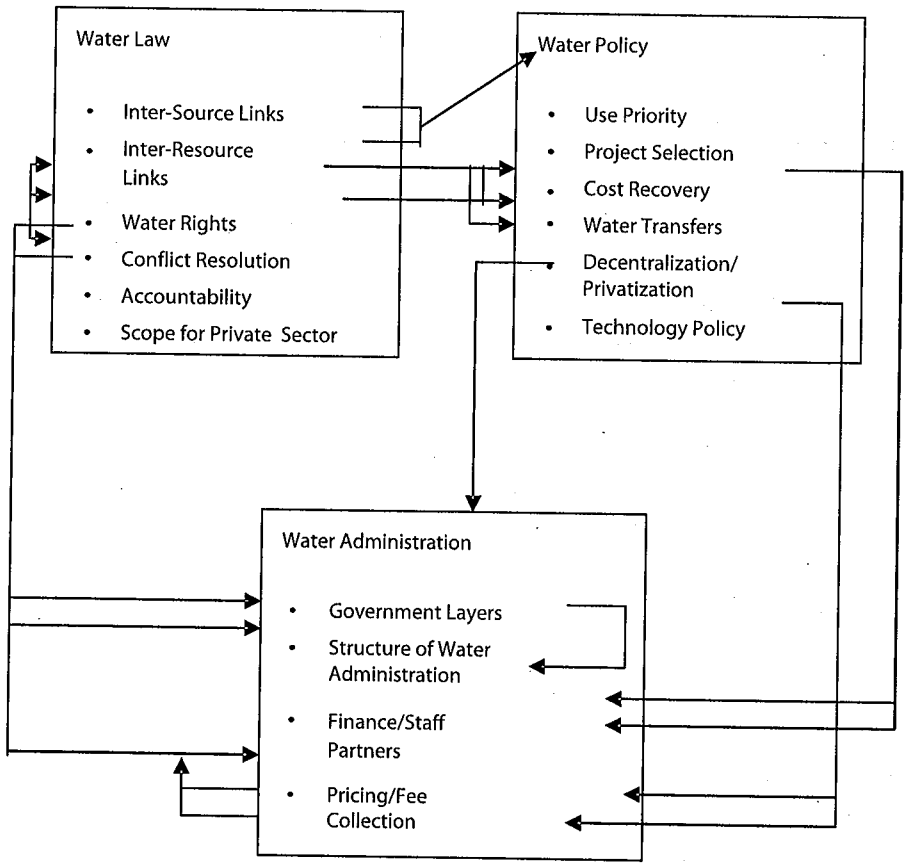
- Project selection criteria
- Pricing and cost recovery
- Water allocation and transfers
- Economic participation
- User participation
- Linkages with other economic policies

Water Administration

- Formal organizations
- Organizational procedures
- Pricing, finance and accountability mechanisms
- Information, research and extension systems

Some of the institutional aspects seem to belong to more than one category. This is so because there are close linkages between the three components. For example, water law usually empowers water policy, and water policy in turn could initiate a process for a new water law. The two components enrich each other. Together they define the structure for the functioning of water administration. The interlinkages of the three institutional components in terms of resources, social capacities, and overall economic objectives can be seen in figure 6, which is extracted from Saleth and Dinar 1999b.

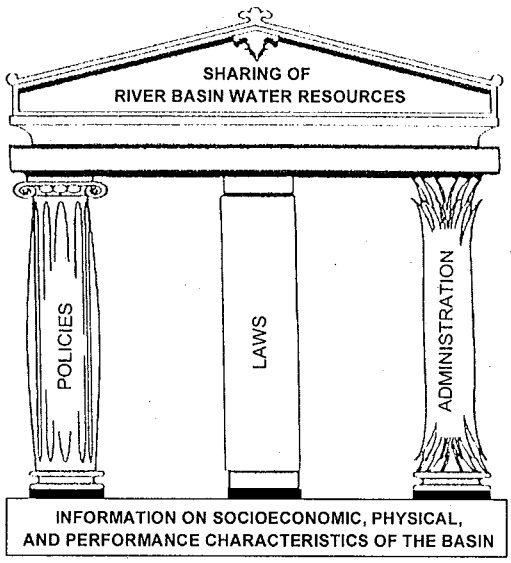
Figure 6. Interlinkages among institutional components.



Classical Temple Metaphor of Institutional Analysis

The metaphor of the classical temple is an appropriate illustration of the combination of principles, processes and activities involved in this suggested method of institutional analysis based on the chosen definition of the institutional framework. Figure 7 depicts this metaphor as adapted from its use by Savenije and van der Zaag (1998). The framework rests on the foundation of diagnostic studies and supported by three pillars of key institutional areas.

Figure 7. The classical temple metaphor indicating river basin institutional development.



Foundation: Diagnostic Study Components

The foundation for the analysis is the four study components conducted in each river basin. Although they are mostly in noninstitutional aspects of the basin, as discussed in chapter 4, each component can be related to the institutional framework of the basin. Steps 1-3 mentioned above will accomplish the work envisaged for this foundation.

Three Pillars of Institutional Analysis

Following the definition adopted under "A Broad Definition of Institutions for This Study," Laws, Policies and Administration are the three pillars of the institutional framework for IWRM in a river basin context. They are very broad categories of institutional elements, and each category, as illustrated in box 5, can consist of a number of institutional elements.

The Pillar of Laws

The legal framework is a very complex set of enactments, subsidiary laws, rules, regulations and procedures, and rights, customs and practices. They are also divided in terms of sources, such as national-, local- and village-level assemblies. There can be laws affecting water management, and laws directly related to water management. The activity that may have been already accomplished during the diagnostic phase could be the inventorying of these legal elements. At this stage of the analysis, each element can be evaluated according to the procedure under "Suggested Method for Institutional Analysis" and "Two Levels of Management" given below.

The Pillar of Policies

Policies are also determined by a number of actors at national level, local or organizational level. Usually, policies and laws are interlinked at the sources, as well as at the implementation level. Some countries have already established water policies and are in the process of formulating laws

to implement them. In the analysis, the elements of this policy framework should be subjected to closer scrutiny in terms of the procedure indicated under "Suggested Method for Institutional Analysis" and "Two Levels of Management" given below.

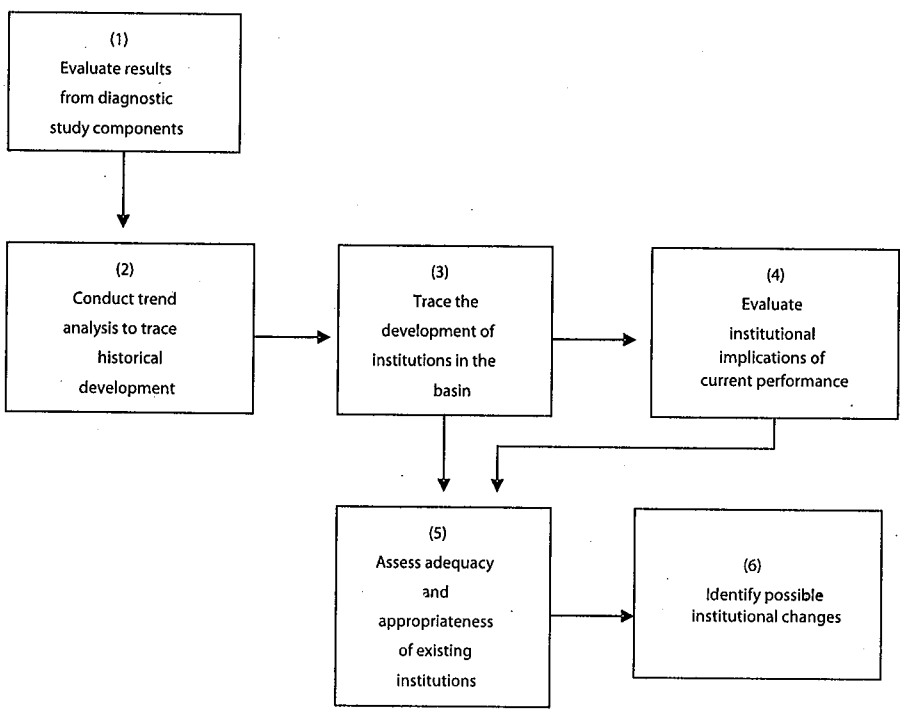
The Pillar of Administration

Administration here means the organizations involved in water management and their internal rules. The process of management is not included. The organizations are necessary for two levels: resource management and delivery management (see under "Two Levels of Management" given below). The evaluation of these organizational elements needs to be conducted in terms of procedures indicated under "Suggested Method for Institutional Analysis" and "Two Levels of Management" given below to explore their effectiveness to undertake coordination among various water use sectors in the river basin, data collection and processing for monitoring purposes, application of water rights, and enforcing various rules related to water management within the river basin.

Suggested Method for Institutional Analysis

The methodological steps that are suggested to be taken in analyzing institutions on the basis of study activities already undertaken are shown in figure 8, which gives a simple flow chart to depict the interrelationships among the steps.

Figure 8. Steps in institutional analysis.



A brief description of each of the six steps is given below.

1. Evaluate the results from four diagnostic study components conducted in the basin (Physical System, Water Accounting, Socioeconomic Situation, and Performance Assessment) to identify institutional implications arising from them.

2. Conduct trend analyses in water availability, water use, infrastructure development and agricultural and irrigation performance to trace the historical development of the river basin.

3. Trace the development of the existing institutional framework related to water management in the basin and compare it with the physical development of the basin over time.

4. Evaluate the institutional implications of current performance levels, to identify key areas of policies, laws and organizational arrangements, which may need to be improved for improved performance.

5. Assess the adequacy and the appropriateness of each key element in the existing institutional framework with reference to steps 1 to 4 above.

6. Identify possible institutional changes.

Some of these steps have already been accomplished in conducting the diagnostic study components in the selected river basins. However, a recapitulation of what has been done according to these steps would give a more structured methodology.

Attention is drawn to relevant sections in the Methodological Guidelines (Samad and Bandaragoda 1999), particularly to section 8 (Stakeholder Analysis), including the procedure on developing a responsibility matrix, and also to appendix 3, which gives a check list for identifying the existing institutional framework.

In a number of areas of data collection and analysis, a trend analysis is highly recommended. This suggestion is strongly grounded on the proposition that an activity to trace the historical development of the basin would throw light on many important aspects of institutional development that has taken place, including the quality of the existing institutional framework in terms of its appropriateness and adequacy. More importantly, it will help in identifying the potential for improvement.

Appropriateness and Adequacy

The following key questions are relevant for assessing whether each institutional element is appropriate and adequate for the current situation in the selected river basin.

Is the institutional element (any element related to laws, policies or organizational arrangements) suitable and adequate for the following?

- The existing physical system in the basin, in terms of soil conditions, topology, rainfall, seasonal weather variations, etc.

- The water availability and quality situation in the basin.
- The existing physical infrastructure available in the basin.
- The existing socioeconomic situation in the basin.
- The current technology used for operations.
- The current performance levels.

This initial evaluation procedure will naturally raise a further set of similar questions on the basis that the existing situation may need some changes. The analyst will have to assume the potential extent and quality of the changes possible and try to relate the answers to suit a domain of attainability.

Each identified institutional element needs to be assessed to ascertain its appropriateness and its adequacy in terms of the potential for performance improvement (see figure 9).

Two Levels of Management

Institutions are necessary for two distinct levels of management: higher-level resources management and lower-level delivery management. Although the set of institutions can collectively cover both levels, often separate organizations are useful to handle the two levels of management tasks. As has been highlighted in other institutional studies (IWMI's BMZ-supported parallel study on "Institutional Support Systems for Sustainable Local Management of Irrigation in Water-Short Basins"), a set of minimum management tasks will form the basis for a functional approach to IWRM.

The Asian Development Bank has suggested a somewhat related functional approach for "National Water Sector Profiles" (Arriëns et al. 1996, Vol. 2, appendix A) from which future developments of this framework document will also draw.

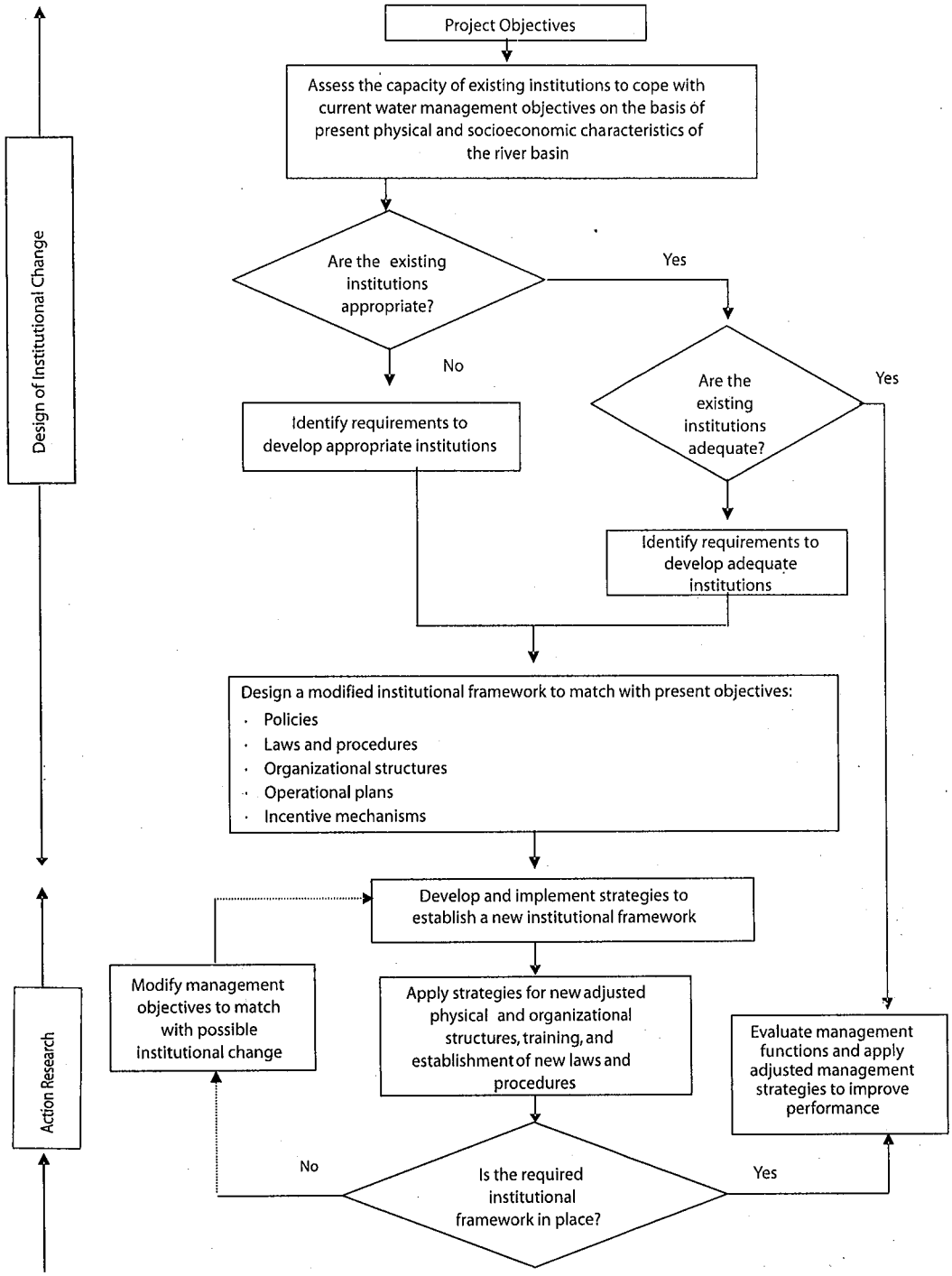
A more recent study report makes a distinction between management of water resources and delivery of water services, and lists a number of key management functions under five categories (Berkoff 1997). The report also points out that functions are distinct from the agencies that could be assigned to perform them, although in a holistic management approach, one agency may be required to have a role in more than one function.

A basic division of various management functions between these two levels can be conceptualized as in the distribution given below:

Water Resources Management Functions

- Policy formulation
- Data collection and dissemination
- Planning
- Public participation and inter-organizational coordination

Figure 9. Assessment of institutions: Adequacy and appropriateness.



- Research and evaluation
- Regulation
- Resource mobilization and macro-level resource allocation

Water Service Delivery Functions

- Design
- Construction
- Operation and maintenance
- Monitoring and evaluation

Strategic Planning

While the institutional framework encompassing both these management levels needs to be analyzed, a state-of-the-art management strategy also needs to be developed, particularly as a guide to be followed during the action phase envisaged in this regional study. Strategic planning will form an essential preparatory task at the beginning of this action phase.

As river basin resources reach full commitment, the interactions at the basin level become critical. Consumption increases in one area must be offset by consumption decreases at another; poorer-quality effluent in an upstream area has direct impacts on downstream entitlements. Other issues—flood zoning, safety and operation of dams—must of course always be regulated and administered at the basin level. Thus the scope of management required is widening and the attention is moving progressively upwards, but the strength of higher-level institutions is probably declining precisely as this is happening. This institutional weakness needs to be remedied in a search for strategies in improving the productivity of agricultural water management.

As the largest user of water in most developing country river basins, better agricultural water management will be the key factor in the long-term sustainable water use in water-scarce river basins. As most basin areas and most stakeholders are both linked with using water resources for agriculture, the minimum set of management tasks can be assessed more closely for agricultural production.

Each water basin is seen as unique in its features, physical, social, environmental and economic. Depending on the contextual factors, the minimum set of management tasks can also be ordered according to their importance. A composite performance indicator may be used to capture the relative importance of these various tasks, and of the different water uses within the basin.

The institutional analysis will finally be aimed at identifying effective institutional arrangements for agricultural water management at two levels in the context of IWRM in a river basin. At the macro-level or basin (or subbasin) level, analysis will deal with institutional arrangements that concern inter-sectoral allocation of water such as for irrigation, domestic water supply, hydropower, environmental purposes and other uses which depend on a common water source. The service-level analysis will focus institutional issues relating to the multiple use of water within the irrigation service area. At this level, interest in other subsectors will only be to the extent that they affect agricultural water use either directly or indirectly. The water users' collective action bodies will be part of this level of institutional development.

Chapter 7

Essential IWRM Functions[3]

Lessons from the Study

Investigations conducted in all developing-country river basins in the study sample point towards a common set of their needs for IWRM. The key items in that common set include: some form of coordination mechanism to allocate and distribute water in an equitable manner; an arrangement to acquire and maintain the necessary basin-wide data to give proper effect to an allocation system; an organization to plan, implement and monitor a program of water allocation and regulation; an adequate policy and legal framework within which such actions could be successfully conducted; and capacity building to train and equip adequate manpower resources to carry out these functions.

In most of the basins, each water user group was almost totally unaware of the details of water use by other groups. For instance, irrigation authorities or irrigators rarely had any knowledge of what the power-generation group was doing to harness water from the same river basin. This was very clear in the case of the Ombilin basin water users (Final Report, Volume IV, chap. 3). In the absence of any information, and also any mechanism to share such information even if it was available, the two user groups had very little chance of resolving a growing dispute about the adverse effect of the power-generation facility on downstream farmers.

Many basin situations were characterized by the absence of any clear policy or legal framework governing the water-allocation function within the basin. In many instances, the laws and policies were in the process of being formulated, and due to lack of sufficient stakeholder consultation, the resultant mistrust arising from misinterpretation of proposed provisions, the process was being obstructed or delayed. The cases of Sri Lanka and Thailand both illustrate the effect of this constraint (Final Report, Volume V). However, given the opportunity to understand and preferably to share the efforts in policy planning, the water user groups and political interest groups are most likely to appreciate the positive elements of reforms. The field consultations with stakeholders in Deduru Oya and Ombilin basins clarified that the actual stakeholders were all ready to understand these needs as they were given the necessary information.

In the Brantas basin study (Final Report, Volume III, chap. 4) reference is given to the Indonesian Government Regulation No. 35 of 1991 on Rivers, Article 2, which deals with development, utilization, conservation and control of water resources. The Regulation has defined river-basin management "as an effort to realize utilization of water resources to satisfy all demands, in an efficient and effective manner, with fair and even distribution, by taking into consideration conservation and control of water and its resources." Further, according to the Regulation statement, river-basin management should be integrated (multi-sector), comprehensive (upstream-downstream), sustainable (intergenerational equity) and based on an environmentally sound concept (ecosystem conservation) with the river basin (hydrological area unit) as one management unit.

[3]This section derives partly from the outcomes of country studies.

Following this dictum, the Brantas river basin organization (Jasa Tirtha, meaning "Water Service") follows the river basin management philosophy of "one river, one plan, and one integrated management." One river (meaning river basin) is a hydrological unit that could cover several administrative areas defined as one management unit. In one river there should be only one integrated, comprehensive, sustainable and environmentally based concept of a development and management plan. One management system should guarantee an integration of policies, strategies and programs as well as implementation of the system for all of its reaches. The scope of river-basin management covers the management of the watershed, water quantity, water quality, flood control, river environment and water-resources infrastructure; and research and development (R&D). Although, Brantas has yet to realize the full potential of these assertions, the philosophy adequately covers most of the essential features of IWRM.

Obviously, the essential functions need to be treated as a set of necessary conditions. There are some other important constraints, such as the physical system, national economy, political system, the development ideology and contextual geopolitical situation, all of which impinge on the management system. Another important influence comes from the value system of the society in which reforms are attempted. The values determine the policies and laws in a given context, and serve to modify any new reforms that are introduced to the society. The fact that there are varying degrees to which IWRM has been applied in the countries studied tends to explain the contextual influence of the value systems.

Coordination

Foremost among the essential functions in the implementation of IWRM is the function of coordinating multiple water uses, multiple stakeholders, multiple issues and concerns, and multiple objectives of water resources management. The Brunets philosophy of "one river, one plan, one management" summarizes the need for coordinating various elements of this complex situation.

Planning

Judging from the confusion that has arisen from haphazard development efforts in some of the countries studied, a key lesson for future water-resources development is the need to plan various activities concurrently. For an effective IWRM program, a comprehensive Basin Plan is essential. Through a basin plan, early decisions can be formulated to optimally consider the quantity and quality of water available in the river basin. Water-resources development should be an attempt to optimally use water potentials and prevent waste, as well as overuse. The Brantas and Deduru Oyo case studies pose the lesson that temporal and spatial variations of water flow in the river are a key consideration in optimal water resources development and management. In the upper reaches, reservoirs are built to control floods, store water during the rainy season and to supply water in the dry season. In the middle and lower reaches, barrages and intakes are built for various purposes (irrigation, industry, drinking water, etc.). Finally, at the estuary, barrages are built to prevent saltwater intrusion into the river. Water resources development should use a holistic, well planned, basin-wide program in order to achieve sustainable and environmentally sound concepts of IWRM.

In many river-basin development and management efforts, the activities are limited to harnessing the water flow, and start from the water diversions. The value of Watershed Management is highlighted as an essential feature of IWRM. Of all the developing-country situations studied, only Brantas had made a conscious effort to consider this activity. It included riverbed conservation, reforestation and other related activities in increasing the sustainability of the watershed. To implement watershed management, coordination among related water use groups and their organizations is imperative, and essentially, water management should be part of the basin plan.

Management of Water Quantity and Water Quality

Identifying water entitlements for various water users is a form of acknowledgment of determining the quantity of water to be used, or the water use rights of each user or group. It also serves as an instrument to monitor the equitable allocation and distribution of available water resources in the river basin. In many countries studied, this is a novel concept and attracts controversy in interpretation, although there has been a system of distributing water according to some agreed system or other. The Water Policy in Sri Lanka has specifically used the term "entitlement," possibly to avoid the harshness of terms such as, "water rights" or "water pricing." Some legal basis of water use licensing is an essential component of any governmental action to introduce IWRM. In Indonesia, Government Regulation No. 22 of 1982 and other subordinate legislation at the provincial level, which cover this requirement, are an exemplary piece of enabling legislation for this purpose. The Philippine Water Code, though it sounds too robust in coverage, clearly provides for the issue of appropriate water use licenses.

As part of managing the water quantity in any basin, flood control measures play a vital role. As practiced in the Brantas, flood-control management attempts to control flood discharges by hydrological observation using telemetric equipment (Flood Forecasting and Warning System), preparing a seasonal weather and flood prediction using a computer facility, which is connected to national and international databases, and by controlling water gates to distribute discharges. Again, the Flood Control Management Plan and Manuals become an essential component of the overall basin plan. For operations during flood disasters, a Basin Flood Hazard Mitigation Unit is an important organizational arrangement.

As water resources are utilized for any purpose, its original pristine quality gets invariably altered, and at some stage of repetitive use, water quality becomes a concern. The licenses need to cover some standard requirement that is considered desirable. In Brantas, effluent discharge standards have set the allowable limit of concentration and amount of pollution load in wastewater discharged by a certain activity. This standard is used for effluent discharge licensing, which provides a basis for controlling water pollution through law enforcement. Monitoring of water quality is carried out periodically, both for river water and for effluent discharge of dominant industries, tested in the laboratory. Monitoring results, evaluation and recommendations are forwarded to the local government as a basis for law enforcement. Pollution control is carried out both in-stream (by means of flushing, increasing the capacity of river assimilation) and off-stream (at pollution sources) through implementing laws and economic instruments, as well as attempting to increase social control by society. Ensuring adequate water quality needs to be part of the basin's Pollution Control Plan.

Data Management

A critically important IWRM function is data management. Various water use sectors handle their own information needs, and also provide information that is useful for the other sectors. Coordination among different user groups requires that this information be collectively managed for the overall benefit of all managers performing various water management functions within the river basin. Data sharing among different groups and agencies needs to be encouraged and operationalized. Organized data are necessary for basin-wide analyses, for research and planning purposes.

Formulation of Policies and Laws

Water is a vital resource in any country. To ensure that this resource is efficiently and effectively used for the benefit of the majority, the nation needs to have a structured system of safeguards, standards, procedures and enforcement rules. IWRM enthusiasts have promoted since long a comprehensive water law and a policy for each country engaged in introducing progressive measures for effective water resources management. Many countries have adopted these proposals. For example, the Government of Indonesia is reforming water resources policy to improve:

- The national institutional framework for water resources development and management.
- The organizational and financial framework for river-basin management.
- The regional water quality management regulatory institutions and implementation.
- Irrigation-management policy, institutions and regulations.

In addition, Indonesia's decentralization policy in Law No. 22 of 1999 on Local Governance states that the local governments shall have authority as much as possible in their own territories, and Government Regulation No. 25 of 2000 on Central Government Authority and Autonomous Provincial Government Authority provides implementation guidance for this law. In applying these regulations in water resources management for any river basin, which covers more than one district or municipality, the basic principle of "one river, one plan, one integrated management" should be kept as the basic principle for the implementation of integrated water resources development and management.

Organizational Options

Omonogawa's advanced basin case study from Japan (ADB Report, Volume III) illustrates that IWRM does not need any prescribed format of organization to have effective water resources management in a river basin. The generic need is some form of coordinating mechanism, a River Basin Organization as in Brantas, a Basin Committee as being proposed in Sri Lanka and China, a central government authority as in Japan, or a combination of all of these.

The essential functions mentioned above, and with additions and deletions as the context demands, need to be performed. In the following table, Tri M. Sunaryo (in Bruns et al. 2002, 285), gives a good example of how the various functions can be implemented by different organizational authorities.

Table 1. Matrix of role and competence of the stakeholders.

Item	Government	RBM A	Society
function	policy and control	operator	users
Task	Set up policy and regulations. Perform public authority (law enforcement, licensing, etc.). Carry out control and	Carry out river utilization in the river basin, covering planning, development, utilization, control and conservation of water resources. supervision on the task of	Use water efficiently in accordance with licenses and other authorized abstractions. Carry out treatment of respective effluent Develop river-manage-
ment	discharge according to performance of the water management agency.	systems to secure the river-basin function.	the license received and the promulgated rules.
Right	Collect tax on surface water use from the beneficiaries. Share the profit of the water management agency according to the promulgated rules.	Collect contributions from the beneficiaries for the commercial services and receive contributions from the government for social services (public safety and welfare).	Receive good services. Participate in decision making in all stages of activities.
Obligation	Guide the water management agency in carrying out its tasks. Contribute to funding of activities for public safety and welfare.	Render prime services to the beneficiaries. Attempt to increase public and private participation in river utilization. Accountable for task performance and fund utilization to the government and the society.	Contribute to funding. Give positive social control. Conserve the environment by participating positively in water-resources conservation activities, such as re-greening, reforestation, terracing, etc.

Annex 1

Methodological Guidelines[4]

Introduction

This document sets out methodological guidelines for research activities to be carried out for the study on the development of effective water management institutions. The guiding principles outlined here provide a basis for analyzing existing institutional arrangements and facilitate the formulation of institutional interventions for improving the management of water available for agriculture in water-scarce river basins. The guidelines are based on discussions amongst research staff at IIMI working on the project. Key elements of the methodology were presented and discussed at a workshop held during 21–26 July 1999. The workshop was attended by senior researchers and officials from the participating countries: China, Indonesia, Nepal, Philippines and Sri Lanka. The workshop was intended to enlist the effective participation of national collaborators in the development of the methodology. Participants' comment, questions, suggestions and views were taken into account in drafting the present text. The proposed application of the methodology in the five participating countries would provide an opportunity to empirically test the concepts and methods. On the basis of lessons from the field tests, we hope to publish a comprehensive and improved version of the methodology for describing and analyzing institutional issues relating to river basin management.

Background to the Study

With recent advances in the understanding of water in river basins there has been a noticeable shift in the perception about irrigation performance. In some basins, individual systems may be inefficient, or efficiency gains from existing systems may be limited because the basin as a whole may be already functioning at a high level of efficiency due to the reuse and recycling of water (see Keller et al. 1996; McKinney et al. 1999). The conventional concept of irrigation efficiency ignores the integrated nature of water resource systems and the potential reuse of irrigation return flows. This could lead to erroneous conclusions and serious misallocation and mismanagement of water resources.

With the recognition of the significant reuse of water, the river basin has been acknowledged as the appropriate unit for the analysis and management of water resources, especially as water availability at the basin level becomes the primary constraint to agriculture. This insight not withstanding, there is also clear evidence of growing scarcity of good quality water in most river basins resulting in intense inter-sectoral competition for water. The adverse effects of a rapid degradation of the environment and other ecological problems discount the utility of already inadequate water supply.

[4]Prepared by M. Samad and D. J Bandaragoda, 1 October 1999.

These developments have made apparent the inherent limitations of existing institutional arrangements to deal with the new set of problems in the water sector. As countries move from a state of plenty to a state of scarcity, water sector institutions have to be reoriented to cater to the needs of changing supply-demand and quality-quantity realties (Saleth and Dinar 1999). It is inevitable that irrigated agriculture, the largest water user in many river basins will be called upon to relinquish supplies it currently withdraws from river basins to other uses.

In the irrigation sector, the institutional weaknesses have been recognized for sometime. The traditional, hierarchical, state-centered irrigation management institutions have proved to be a barrier for improving irrigation system management. In many countries, attempts at institutional reform in the irrigation sector have focused on enlisting the participation of farmers in irrigation management by devolving some management responsibilities to water user groups. Different varieties of participatory management arrangements have been experimented with over the past two decades and there has been some degree of success. But, realizing the full benefits has been hampered by policy and institutional constraints at levels above farms and irrigation systems. There is now widespread acceptance of the necessity to focus on higher-level institutions, generally at the basin level. In Asia, this view was reinforced at regional conferences sponsored by the Asian Development Bank in 1996 (see Arriens et al. 1996) and the Global Water Partnership (1997). Integrated approach to water resources management and service delivery in a basin context is now a key component of the Asian Development Bank's policy on water (ADB 1998).

At present there is no agreement about the most appropriate organizational forms and institutional arrangements that can be recommended for basin-level management or whether there are potentially effective techniques and arrangements useful under different conditions. Also, the likely effects of alternative water allocation policies remain unclear. This study which is being carried out in selected basins in five countries attempts to fill these gaps in knowledge and provides a basis for water policy and strategic institutional interventions at the basin level. The findings of the five-country case studies will provide a comparative perspective to develop generalizable "best practices" for river basin management under alternative conditions.

Scope and Objectives

The main focus of this study is on institutional capacities relating to the consumptive uses of water, especially in agriculture, which is by far the largest and most complex user of water in most river basins. Nonconsumptive uses like hydropower generation, navigation, recreational and other environmental uses are considered only to the extent that they affect consumptive uses either directly or indirectly. We use the term agricultural water management in recognition of the multiple uses of water supplied to irrigate crops in the main field: for domestic needs, animal husbandry, home gardening, inland fishery, nonagricultural enterprises and some environmental functions (IWMI 1999).

Objectives

The overall objective of the study is to improve the management of water resources available for agriculture in river basins where there is growing inter-sectoral competition for water, and associated environmental, social and institutional issues arising form such water scarcity.

The specific objectives of the study are:

- To carry out a detailed analysis of existing institutional arrangements for water resources management in selected river basins with a view to identify constraints and opportunities relating to agricultural water management, particularly in the context of inter-sectoral competition for water.

- To apply and validate a conceptual framework for analyzing the institutional arrangements for water resources management.

- To develop and initiate the implementation of policies and institutional strengthening programs that will lead to improved management of water available for agriculture.

Key Research Questions

The key research questions that need to be answered to realize the objectives are:

- What is the hydrological resource endowment of the river basin?

- Who are the present users of water, and what are the present patterns of water use differentiated by sector, public and private uses, gender and income level?

- What are the formal and informal institutional arrangements for sharing water between uses within the basin and what provisions (or potential) exist for satisfying the unmet water needs of disadvantaged groups, such as women, children and the poor?

- How do the present formal and informal arrangements for allocating and managing water between uses affect equity and productivity of agricultural water use within the river basin?

- What is the nature of conflicts between uses and the means for conflict resolution within the basin?

- What can we say about the future trends and scenarios, with special reference to the future of irrigated agriculture and access to water resources by poor women and men?

Concepts and Definitions

River Basin

In texts on hydrology, a water basin is typically defined as the entire geographical area from which water drains to the point at which the river flows to a sink (i.e., the sea). For purposes of this study, we adopt this definition, but may consider the entirety of such a river basin or a part of a basin (subbasin) defined by the location of its stakeholders who have an interest in one or more particular watershed management problems and who have the ability to address and solve them.

Institutions

Institutions are the rules of the game in a society or more formally are the humanly devised constraints that shape human action (North 1990). They set the ground rules for resource use and establish the incentives, information, and compulsions that guide economic outcomes.

Organizations are networks of behavioral roles arranged into hierarchies to elicit desired individual behavior and coordinated actions obeying a certain system of rules (Cernea 1987). This hierarchical arrangement is the "organizational structure."

Organizations and institutions are not mutually exclusive. How organizations come into existence and how they evolve are fundamentally influenced by the institutional framework. In turn, the organizations influence how the institutional framework evolves. Thus, in this study, we use the term institutions to encompass both the rules and the role structures (organizations).

The Approach

The methodology outlined in this text requires the analyst to go from description to a detailed analysis of institutional arrangements for water resources management. Description in this context refers to collecting and presenting information on the physical resource base, the prevailing social and economic conditions in the river basin, and the current institutional arrangements for water resources management. The descriptive phase is intended to give a cogent account of each sub-sector within in the river basin, and demonstrating how the various sub-sectors relate to and interact with one another.

The key research activities to be undertaken during this diagnostic phase of the study will be:

- Identifying the physical characteristics of the selected river basin (Technical Survey).
- Water accounting within the basin to assess its resource endowment.
- Conducting a socioeconomic and institutional survey in the basin area to assess the socioeconomic conditions in the area through an appropriate sample of the stakeholders, and also to inventorize the existing institutions related to water management within the basin.
- Assessing the performance of irrigation systems within the selected river basin.

These diagnostic surveys and the performance indicators developed in the last item will form the basis for a detailed analysis of the existing institutions (both rules and role structures). Figure 5 depicts the linkages between the main research activities and their corresponding outputs. The final output is the action plan derived from an analysis of the institutional framework in the light of present performance levels and the views of stakeholders.

Physical Survey

An initial understanding of the physical characteristics of the selected river basin is a good starting point for field work.

The location of the basin, topographical features, climatic and ecological setting, the origin of the water way, its tributaries, and the natural drainage system are some of the key characteristics that need to be identified and documented.

Along with this exercise, a survey will be conducted to identify modifications made through various development interventions, the details of the infrastructure developed, their scope and purposes, different uses and location of facilities.

Appendix 1 gives a checklist, which can be used as a guide to facilitate a preliminary assessment and characterization of the physical resource base of the river basin, the land use pattern, and the compilation of an inventory of assets associated with the water sector.

Appendix 2 gives additional guidelines for water accounting in a river basin.

Appendix 3 gives a checklist for identifying the existing institutional framework.

Information collected from this activity will be used in the preparation of a Report on Physical Characteristics of the River Basin. Part of this information will contribute to the preparation of a Basin Profile, which will also include information from socioeconomic and institutional surveys.

Water Accounting[5]

The water accounting methodology is based on a water balance approach. Water balances consider inflows and outflows from basins, subbasins, and service and use levels such as irrigation systems or fields. An initial step in performing a water balance is to identify a domain of interest by specifying spatial and temporal boundaries of the domain. For example, a domain could be an irrigation system bounded by its headworks and command area, and bounded in time for a particular growing season. Conservation of mass requires that for the domain over the time period of interest, inflows are equal to outflows plus any change of storage within the domain. Water accounting considers components of the water balance and classifies them according to uses and productivity of these uses.

Conceptually, the water balance approach is straightforward. Often though, many of the components of the water balance are difficult to estimate or are not available. For example, groundwater inflows and outflows to and from an area of interest are difficult to measure. Estimates of actual crop consumptive use at a regional scale are questionable. And drainage outflows are often not measured, as more emphasis has been placed on knowledge of inflows to irrigation systems or municipal water supply systems. In spite of the limitations, experience has shown that even a gross estimate of water balances for use in water accounting can be quite useful to managers, farmers and researchers.

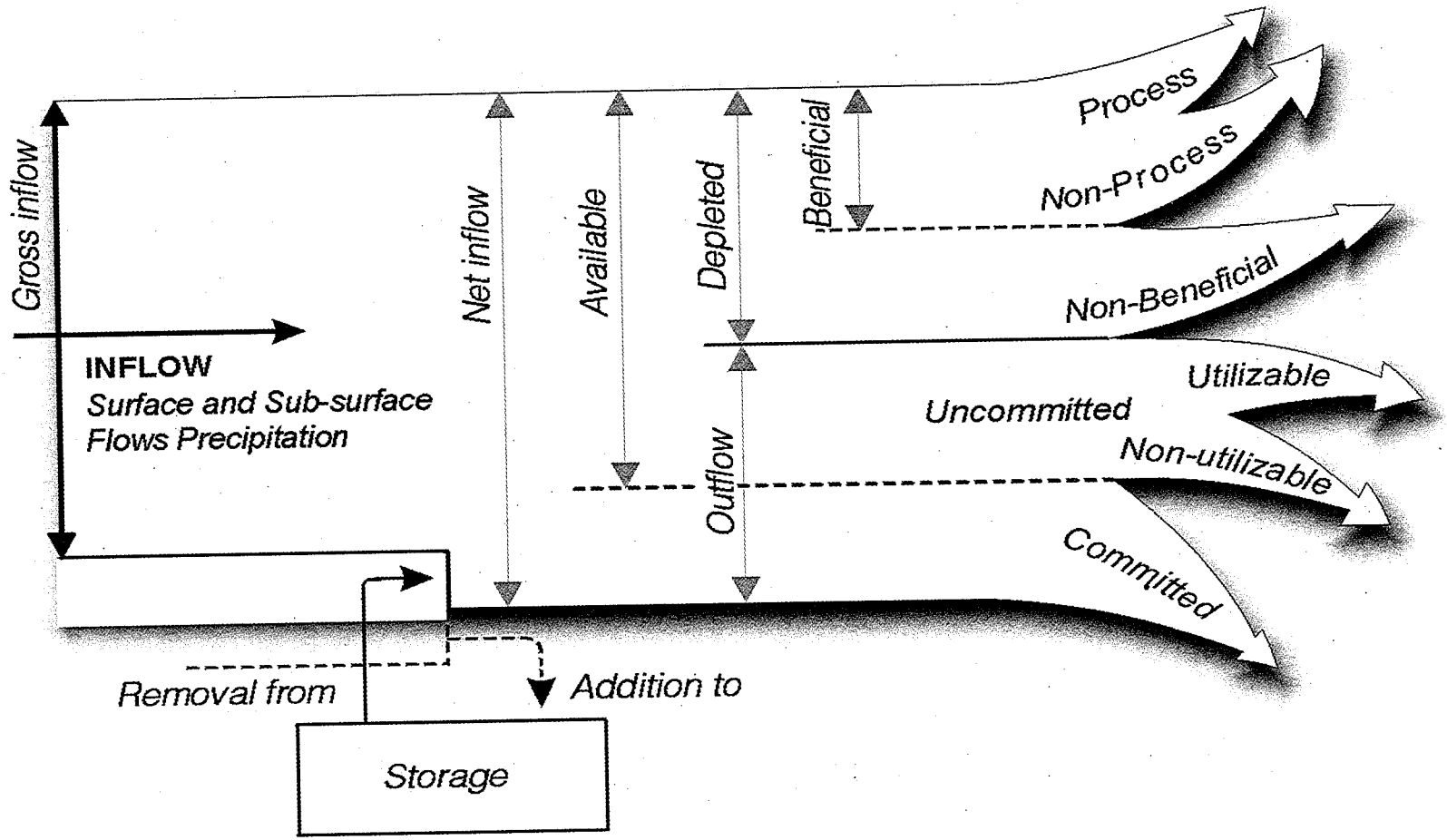
Water Accounting Definitions

Figure 1 (of this annex) visualizes the conceptual framework for water accounting. The definitions of the terms indicated in the figure are as follows:

Gross inflow is the total amount of water flowing into the domain from precipitation, and surface and subsurface sources.

[5]This section is based on Molden and Sakthivadivel 1999.

Figure 1. Water accounting framwork.



Net inflow is the gross inflow plus any changes in storage. If water is removed from storage over the time period of interest, net inflow is greater than gross inflow; if water is added to storage, net inflow is less than gross inflow. Net inflow water is either depleted, or flows out of the domain of interest.

Water depletion is a use or removal of water from a water basin that renders it unavailable for further use. Water depletion is a key concept for water accounting, as it is often the productivity and the derived benefits per unit of water depleted we are interested in. It is extremely important to distinguish water depletion from water diverted to a service or use, because not all water diverted to a use is depleted. Four generic processes deplete water, the first three described by Seckler (1996) and Keller and Keller (1995). A fourth type of depletion occurs when water is incorporated into a product. The four generic processes are:

1. Evaporation: water is vaporized from surfaces or transpired by plants.
2. Flows to sinks: water flows into a sea, saline groundwater, or other location where it is not readily or economically recovered for reuse.
3. Pollution: water quality gets degraded to an extent that it is unfit for certain uses.
4. Incorporation into a product: this is by a process such as incorporation of irrigation water into plant tissues.

Process consumption is that amount of water diverted and depleted to produce an intended good. In industry, this includes the amount of water vaporized by cooling, or converted into a product. For agriculture, it is crop consumptive use plus that amount incorporated into plant tissues.

Non-process depletion occurs when diverted water is depleted, but not by the process it was intended for. For example, water diverted for irrigation is consumed by crop transpiration (process), and by evaporation from soil and free water surfaces (non-process). Drainage outflow from coastal irrigation systems and coastal cities to the sea is considered non-process depletion. Deep percolation flows to a saline aquifer may constitute a non-process depletion if the groundwater is not readily or economically utilizable. Non-process depletion can be further classified as beneficial or non-beneficial. For example, a village community may place beneficial value on trees that consume irrigation water. In this case, the water depletion may be considered beneficial, but depletion by these trees is not the main reason why water was diverted.

Committed water is that part of outflow that is committed to other uses. For example, downstream water rights or needs may require that a certain amount of outflow be realized from an irrigated area. Or, water may be committed to environmental uses such as minimum stream flows, or outflows to sea to maintain fisheries.

Uncommitted outflow is water that is not depleted, or committed, and is thus available for a use within a basin or for export to other basins, but flows out due to lack of storage or operational measures. For example, waters flowing to a sea in excess of requirements for fisheries, environmental, or other beneficial uses are uncommitted outflows. With better management, or additional storage, this uncommitted outflow can be transferred to a process use such as irrigation or urban uses. Uncommitted outflow can be classified as utilizable, or nonutilizable. Outflow is

utilizable if by improved management of existing facilities the water could be consumptively used. Nonutilizable uncommitted outflow exists when there are insufficient facilities to capture the outflow. An example of noncommitted nonutilizable outflow is the large part of the Ganges outflow during monsoon season that is in excess of environmental needs, but flows out due to lack of storage.

Closed basin[6] (Seckler 1996) is one where there are no utilizable outflows in the dry season. An open basin is one where uncommitted utilizable outflows exist. In a fully committed basin, there are no uncommitted outflows. All inflowing water is committed to various uses. In this case, major options for future development are reallocation among uses, or decreasing non-process, non-beneficial depletion of water, or importing water into the basin.

Available water is the net inflow less the amount of water set aside for committed uses and less unutilizable uncommitted outflow. It represents the amount of water available for use at the basin, service, or use levels. Available water includes process and non-process depletion, plus uncommitted water.

Nondepletive uses of water are uses where benefits are derived from an intended use without depleting water. In certain circumstances, hydropower can be considered a nondepletive user of water if water diverted for another use such as irrigation passes through a hydropower plant. Often, a major part of in-stream environmental objectives can be nondepletive when outflows are used downstream.

Preparation of a Basin Profile

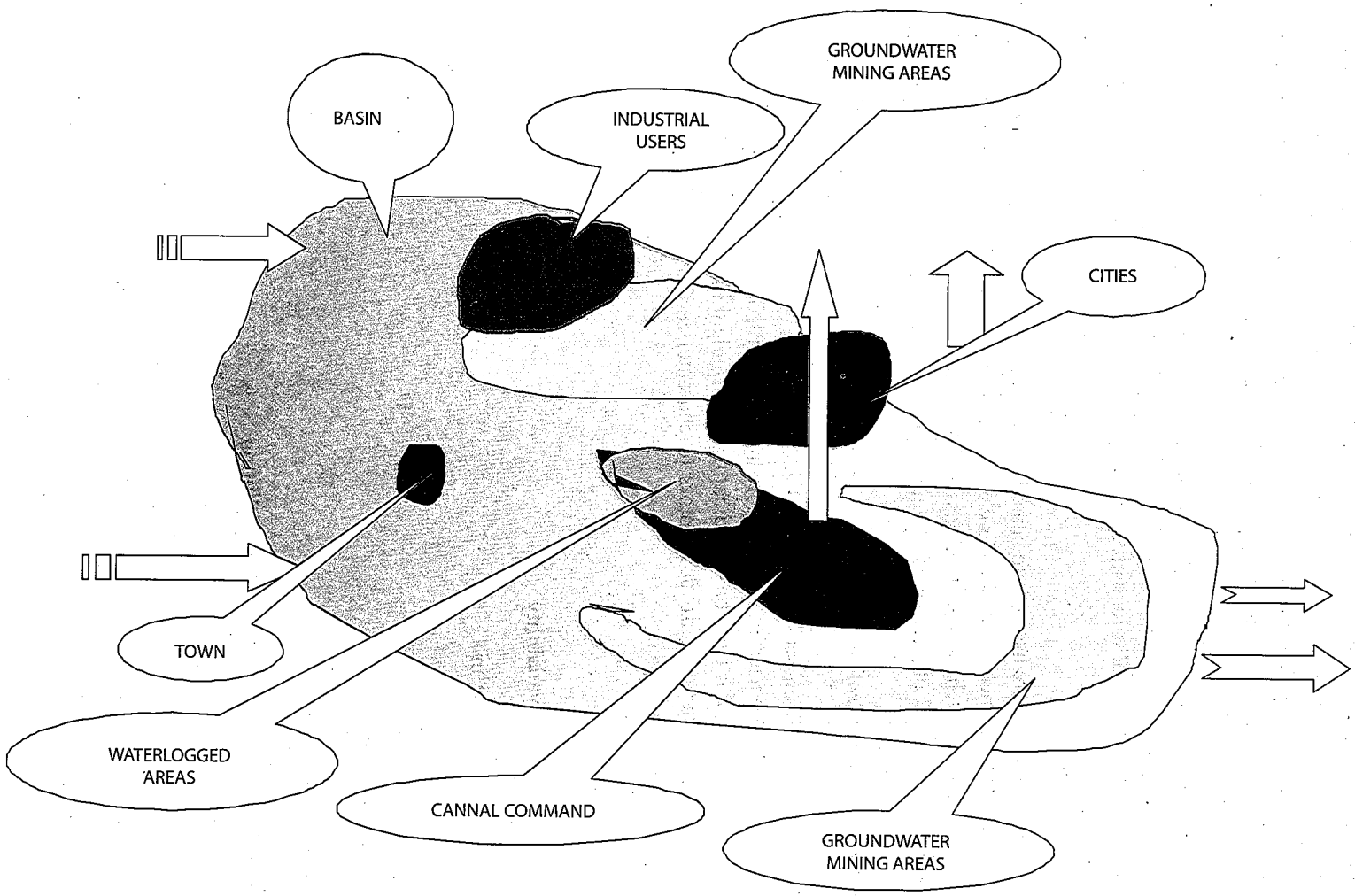
The water accounting framework illustrated in figure 1 and the terminology defined in the preceding section could be used to prepare a hydrologic profile of a rive basin. Figure 2 gives a schematic representation of a river basin indicating the principal uses of water. The following set indicators may be used as standard descriptors to characterize the basin at three levels: basin, irrigation service and field levels.

Basin level

- Per capita water availability
- Per capita water use in
  Agriculture
  Industry
  Domestic
  Environment
- Equity of water supply
- Waterlogging/groundwater mining/pollution
- Surface water pollution

[6]This water accounting definition differs from a strict hydrologic definition of a closed basin where outflows go only to internal seas, lakes, or other sinks.

Figure 2. Schematic representation of water flow in a river basin.



Service level

- Land and water productivity indicators
- Equity indicators
- Environmental indicators

Farm level

- Productivity and profitability indicators
- Equity indicators
- Health and environmental indicators

Boxes 1 and 2 give an example of water accounting for the Nile river basin.

Box 1. Basin-level accounting, Nile river.

Water accounts are shown for the Nile river downstream of the High Aswan Dam in Egypt (box 2). Figures used in the accounts are based on water balance studies for the water year 1993/94. While some of the water balance terms are under debate, the information is sufficiently adequate to give a good picture of water use and productivity.

The gross inflow into the Nile system is 56.2 km^3 consisting of 55.2 km^3 of releases from the High Aswan Dam (HAD) plus 1.0 km^3 of precipitation. It is assumed that over the one-year time period there are no storage changes, so the gross inflow is equal to net inflow. Major process uses of Nile water are for municipal, industrial, agricultural and navigation uses. The total water consumed by crop evapotranspiration is estimated at 36.8 km^3, while process consumption by M&I uses is estimated at 2.3 km^3[1]. During much of January, the Nile irrigation system is closed for maintenance. During this time, 1.2 km^3 of outflow went to the sea because water was released to the Nile to keep levels high enough to support navigation. This amount is charged to process depletion of navigation.

Some water is required to flow out of the Nile system for environmental reasons, some of which are: to drain out salts, to carry out pollutants that would otherwise concentrate in the Nile waters, and to maintain coastal estuaries for fishing. With our present knowledge it is difficult to give an estimate for the volume of outflow required, but there are indicative values. A first estimate of minimum outflow around 8 km^3 is made here for illustrative purposes, but it is recognized that further research is required to quantify this number.

Most of the outflow is through the drainage system. Some of this water can be considered to meet the environmental commitment discussed above. The remainder of the water is considered a non-process, non-beneficial drainage outflow. In 1994/95, the amount of drainage outflow to the Mediterranean Sea, the northern lakes, and the Fayoum Depression was 13.0 km^3. Subtracting 8 km^3 of committed outflow from the drainage outflow yields 5.0 km^3 of non-process depleted water leaving the domain.

Other non-process depletions are evaporation from fallow land, evaporation from free water surfaces, and evaporative use by phreatophytes and other nonagricultural vegetation. Certainly, some of this depletion is beneficial as it leads to the desirable green belt along the Nile. There may be other subsurface outflow into sinks, such as flow from the Nile delta to the Qatara depression where further research is required, but here the value is assumed to be negligible. The non-process, evaporative depletion during the time period of interest was estimated at 3 km^3.

How can productivity of water be increased? First, it is worth noting that there are no utilizable, noncommitted outflows remaining to be tapped. There exists some non-process, non-beneficial depletion, the largest component of which is the drainage outflow to the sea in excess of environmental requirements. Cost-effective methods to reduce this drainage outflow, and convert it into a process use will result in increases in water productivity. Other opportunities lie in increasing the productivity of water consumed by agricultural crops through activities that increase the value of production per unit ET, such as improved varieties, switching from a low- to high-value crops, better agronomic or irrigation practices.

Source: Molden and Sakthivadivel 1999.

Box 2. Subbasin accounts for Egypt's Nile river below the High Aswan Dam.

Inflow	Total km^3	Component km^3
Gross Inflow	56.2	
Surface diversions from High Aswan Dam		55.2
Precipitation		1.0
Subsurface sources from outside subbasin		0.0
Surface drainage sources from outside subbasin		0.0
Storage change	0.0	
Surface		0.0
Subsurface		0.0
Net Inflow	56.2	
Outflow		
Total Outflow	14.2	
Surface outflow from rivers		1.2
Surfac e outflow from drains		12.5
Subsurface outflow		0.0
Flow to Fayoum depression		0.5
Committed Water	8.0	
Environment maintenance (assumed)		8.0
Available Water		
Total (gross inflow less committed water)	48.2	
Depletive use		
Process depletion	40.3	
Evapotranspiration		36.8
M&I Uses		2.3
Navigation		1.2
Non-process depletion	8.0	
Outflows in excess of environmental requirements		5.0
Other evaporation (phreatophytes, free water surface)		3.0
Total Depletion	48.3	
Accounting Indicators	**Value**	
Depleted Fraction		
of Gross Inflow	0.86	
of Available Water	1.00	
Process Fraction- All Uses		
of Gross Inflow	0.72	
of Depleted Water	0.83	
of Available Water	0.84	
Process Fraction for Irrigated Agriculture		
Available for Agriculture in km^3	44.7	
Irrigated Agricultural Process Fraction	0.82	
Productivity of Water		
Gross Value of Production 1993 in billions of 1993 US$	7.5	
Net Value of Production in 1993 in billions of 1993 US$	6.7	
Gross Value of Production per Unit of	$/ m^3	
Gross Inflow	0.13	
Water Available for Agriculture	0.16	
Crop Evapotranspiration	0.20	
Net Value of Production per Unit of		
Gross Inflow	0.12	
Water Available for Agriculture	0.15	
Crop Evapotranspiration	0.18	

Socioeconomic Survey and Stakeholder Analysis

Stakeholders are a group of people, organized or unorganized, who share a common interest or stake in a particular issue or system. They can be at any level or position in society: from global, national and regional concerns down to the level of the household or intra-household, and be groups of any size or aggregation.

Stakeholder analysis can be defined as an approach or procedure for gaining an understanding of a system, and assessing the impact of changes to that system through comparative analysis of the different perspectives and sets of interests of stakeholders in that system, which in this study is a river basin. In other words, it is a process for assessing the differential consequences for stakeholders arising from a particular course of action (or inaction) indicating winners, losers, and trade-offs. In the context of river- basin management, stakeholder analysis is important because any policy or management intervention is likely to have differential consequences on different groups or individuals. Unless we know the differential effects, it is impossible to assess the value of an intervention. More specifically, stakeholder analysis is an attempt to:

- Explicitly recognize the potential trade-off between different policy objectives and interventions between stakeholders' interests that could facilitate good project design/ intervention and improve the likelihood of successful implementation.

- Explicitly analyze the interests of, and impacts of intervention on, different stakeholders including the poor women and men, and other disadvantaged and underrepresented groups.

Operationalizing Stakeholder Analysis

Stakeholder analysis requires the identification of stakeholders, assessment and comparison of interests and identifying inherent conflicts, compatibilities and trade-offs.

Step 1. Identify principal stakeholders and construct a typology of stakeholders.

Initial groupings may be:

- Organizations that affect (determine) a decision or action, i.e., government agencies.

- Those affected by the decision or action, i.e., resource users.

A classification by "Interest" groups may be attempted. In a river basin such a categorization may include:

- Irrigators

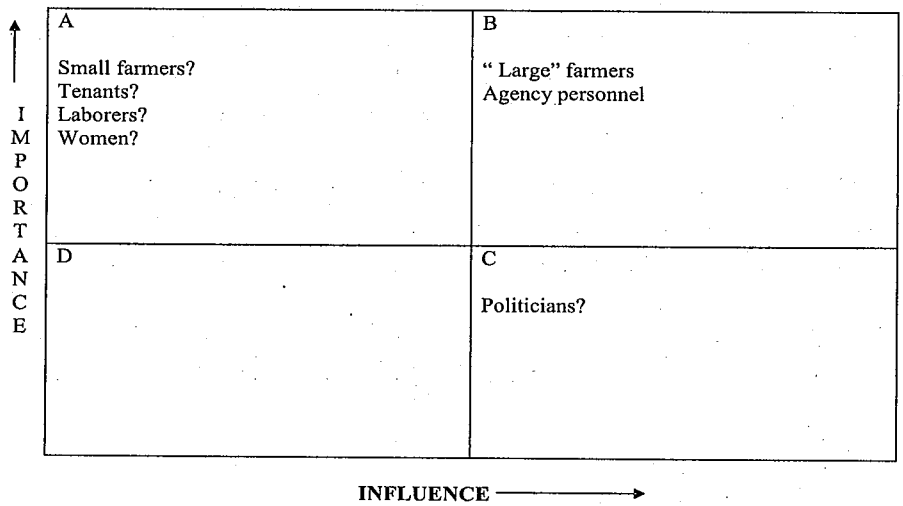
- Domestic water consumers

- Industrialists

- Hydropower plant managers
- Navigators
- Fisher folk
- Users of the river for bathing and other personal needs, etc.

Step 2. Investigate stakeholder interests, characteristics and circumstances.

a. Develop an influence and importance matrix (see below).



a. Identify patterns and contexts of interaction between stakeholders.

b. Identify risks and assumptions for stakeholder cooperation.

c. Interview stakeholders to identify conflicts and tradeoffs.

- Conflicts are situations of competition and potential disagreement between two or more groups of stakeholders.
- Trade-off is the process of balancing conflicting objectives where a sacrifice or opportunity cost in terms of benefits is foregone.

Box 3 classifies conflicts and trade-offs according to the levels at which conflicts could occur.

Box 3. Trade-offs and conflicts at different levels.

Level	Trade-offs	Conflicts of interest
Macro – Macro	Between policy objectives (Forest conservation vs. expansion in area under cultivation)	Between national line departments, i.e., Forest Department vs. Agriculture
Macro- Micro	National and local interests. Large dam for hydropower/ agriculture vs. local population displacement	National agencies and local communities
Micro- Macro	Private and public interests (society at large), i.e., shifting cultivators and conservationists	Local groups and environmental lobby groups
Micro-Micro	Localized inter-sectoral competition, i.e.,water for agriculture vs. domestic water needs	Farmers and consumers

Source: Grimble and Wellard 1997.

Identifying Roles and Responsibilities of Government Agencies

The next stage of stakeholder analysis will involve the identification of government agencies responsible for various functions in the river basin. A responsibility matrix as illustrated in table 1 could be used for this purpose. The matrix identifies the agencies that are involved and the nature of their responsibility (i.e., executive, regulatory, consultative, supervisory, advisory, etc.). This task will require the scrutiny of government legislation, ordinances and other official documentation.

The identification of agencies should be followed with a detailed specification of the allocation of responsibilities to various persons within an organization. This would include identifying who the people involved are, tasks for which they are responsible and how they are carried out. Table 2 is given as an example for recording the division of responsibilities within WUAs.

Table 1. Responsibility matrix.

Tasks	Agencies responsible for identified tasks (use code)			
	Agency A	Agency B	Agency C	Agency D
Governance				
Water allocation for different uses				
Water distribution				
Water quality protection and salinity management				
Flood protection				
Wetland protection				
Groundwater management				
Maintenance of infrastructure				
Master planning				
Design and construction of new facilities				
Resource mobilization				
Impact assessment studies				

Source: IWMI 1999a.

Table 2. Task responsibilities and activities within WUAs.

Essential task	Activity	General Meeting	WUA President	General Secretary	Field Technician	Farmer
Governance	Formulation of policy on water distribution	●	●	●		
	Conflict resolution		●	●		
	Enforcing rules		●	●		
	Formulating policy on fee levels	●	●	●		
	Formulating policy on maintenance	●	●	●		
Water distribution	Planning			●		
	Implementing			●	●	
	Monitoring and evaluation			●	●	
Maintenance	Identification			●	●	
	Planning			●		
	Implementation			●		
	Supervision			●	●	
	Paying/accepting		●	●		
	Recording			●		

Source: IWMI 1999a.

Performance Assessment

Performance of Irrigated Agriculture

As noted earlier the major goal of this study is to develop institutions that would help to improve agricultural water management. Therefore, it is important to know how irrigated agriculture is performing under the existing institutional arrangements. In this study current performance of irrigated agriculture is assessed in terms of nine indicators as follows:

1. Output per unit of cultivated area ($/ha) $= \frac{\text{Production}}{\text{Irrigated cropped area (ha)}}$

2. Output per unit of developed (command) area ($/ha) $= \frac{\text{Production}}{\text{Command area (ha)}}$

3. Output per unit of irrigation water ($/m^3) $= \frac{\text{Production}}{\text{Diverted irrigation supply (m}^3\text{)}}$

4. Output per unit of total water supply ($/m^3) $= \frac{\text{Production}}{\text{Diverted irrigation supply + annual rainfall (m}^3\text{)}}$

5. Relative water supply $= \frac{\text{Total water supply}}{\text{Crop demand}}$

6. Relative irrigation supply $= \frac{\text{Total irrigation supply}}{\text{Crop demand}}$

7. Financial self-sufficiency $= \frac{\text{Revenue from irrigation}}{\text{Total O \& M expenditure}}$

where,

Production	=	Output of the irrigated area in terms of gross or net value of production measured at local or world prices.
Irrigated cropped area	=	The sum of areas under crops during the time period of analysis.
Command area	=	The nominal or design area to be irrigated.
Diverted irrigation supply	=	Volume of surface irrigation water diverted to the command area and net if groundwater draft for irrigation.
Total water supply	=	Surface diversions plus net groundwater draft plus rainfall.
Revenue from irrigation	=	Revenue generated from fees and other locally generated income.
Total O&M expenditure	=	The amount expended locally for O&M plus any government's recurrent expenditure for irrigation.

Boxes 4a and 4b give the data requirements and computations of the irrigation performance indicators, respectively, using data relating to three systems in Burkina Fuso.

Box 4a. Data input.

Irrigation system	=	SAGA	KOURANI - BARIA I	KOURANI - BARIA II
Year	=		June 93 – May 94	Jan 94 – Dec 94
Jan 94 –Dec 94				
1. Developed area	ha	470.3	425.0	267.8
2. Area cultivated in the year	ha/yr.	760.0	750.4	454.5
3. Rain volume on irrigated area	m^3/yr.	1,736,600	2,281,000	1,270,900
4. Water delivered into the irrigation system	m^3/yr.	9,102,000	11,441,000	5,099,000
5. Total water available(3) + (4)	m^3/yr.	10,839,000	13,909,000	6,705,000
6. Crop water demand	m^3/yr.	4,934,000	4,856,000	2,998,000
7. Irrigation supply at fields	m^3/yr.	3,112,000	3,443,000	2,324,000
8. Total water supply at fields (3) + (7)	m^3/yr.	4,849,000	5,524,000	3,595,000
9. Irrigation demand at fields (6) - (3)	m^3/yr.	3,197,000	2,575,000	1,727,000
10. Gross product value at external prices	US$/yr.	1,055,790	620,479	503,266
11. Cost of operation and maintenance	FCFA/ha/yr.	88,396		
12. Irrigation service fees collected	FCFA/ha/yr.	123,077	120,500	121,930

Box 4b. The Performance indicators.

Irrigation system		=	SAGA	KOURANI - BARIA I	KOURANI - BARIA II
1. Output per unit of cultivated area	(10) /(2)	US$/ha	1,389	827	1,107
2. Output per unit of command area	(10) / (1)	US$/ha/yr.	2,592	1,460	1,879
3. Output per unit of irrigation water	(10) / (4)	US$/m^3	0.116	0.054	0.099
4. Output per unit of available water	(10) /(5)	US$/m^3	0.097	0.045	0.075
5. Relative water supply	(8) / (6)	-	0.983	1.138	1.199
6. Relative irrigation supply	(7) / (9)	-	0.973	1.259	1.346
7. Financial self-sufficiency	(12) / (11)	-	1.392		

By way illustration boxes 4a and 4b give the data requirements and computations of the irrigation performance indicators respectively using data relating to three systems in Burkina Faso.

Assessment of Basin-Level Performance

Basin-level performance is measured in terms of:

a. Utilization (%) = $\frac{\text{Total depletion}}{\text{Available water}}$

b. Basin Water Productivity (US$/m^3) = $\frac{\text{Gross value of output (US\$)}}{\text{Available water (m}^3\text{)}}$

Figure 2 (of their annex) is an illustration of the water flow in a basin from the primary source to the sink (sea). Box 5 gives the method of computation of the basin-level performance measures.

Institutional Analysis

Dynamic Process of Institutions

As defined under "Physical System and Institutions," for the purpose of this study, the term "institutions" includes both the rules and the organizations governed by such rules. Basically, institutions are the rules underlying organized human actions. The rules may be in the form of written laws, or unwritten norms, conventions and traditional practices accepted by the society. These rules define and fashion the behavioral roles of individuals and groups in a given context of human interaction, aiming at a specified set of objectives. In this sense, it is a cyclic phenomenon in which institutions are primarily determined by human action, and once established they, in turn, determine the scope and character of subsequent human action for desired objectives. Also, the behavioral roles determined by an initial set of rules, in turn, may surface the need for certain periodic changes in such rules.

This cyclic nature allows for a dynamic process in institution building to cope with inevitable change. It also helps to establish a balance between the dual facilities inherent in institutions to

Box 5. Computation of basin-level performance indicators.

Primary Diversion	=	100 units			
Secondary Diversion	=	50 + 55 + 25 = 130 units			
Return flow	=	Seco. Div. / Primary Div.			
	=	$\frac{130}{100}$	=	1.3 or 30%	
Process Consumption	=	25 + 35 + 16	=	76 units	
Non-beneficial Depletion	=	5 + 3 + 4	=	12 units	
Total Depletion	=	88 units			
Available Water	=	100 - 7	=	93 units	
Basin Utilization	=	$\frac{88}{93}$	=	95%	
Local Efficiency	System 1		=	$\frac{25}{50}$	= 50%
	System 2		=	$\frac{35}{55}$	= 64%
	System 3		=	$\frac{16}{25}$	= 64%
Effective Efficiency	System 1		=	$\frac{25}{30}$	= 83%
	System 2		=	$\frac{35}{38}$	= 92%
	System 3		=	$\frac{16}{20}$	= 80%
Basin is closed	=	No utilizable outflow			
Gross value of Product	=	US$ 2,179,535			
Available Water	=	9.3×10^6 m^3			
Basin Water Productivity	=	$\frac{2.179535 \times 10^6}{9.3 \times 10^6}$			
	=	\$ 0.23/m^3			

both constrain and liberate individual and group action (Bromley 1987). The dual facilities of institutions are of particular importance in irrigation and water management. Most water-related rules are meant to constrain the undesirable behavior by individuals and groups in the distribution and use of water. Some of the water-related rules are also designed to promote organized behavior and equity and provide various opportunities for individual and group advancement. Dualism also exists when some informal rules contradict formal rules. A dynamic process of institutional adaptation, therefore, corresponds to a need to maintain a balance between these dual functions of institutions.

Common Errors

In popular usage, however, "institutions" are usually regarded as "organizations." The connotation becomes much more common in the use of the term "institution building," which most often refers to the building up of new organizations (parastatal bodies, additional units in existing agencies,

farmer organizations, etc.). Often, the importance of rules is ignored in view of a preoccupation on organizational development. This lapse seems to have resulted in the limited success so far achieved in establishing appropriately comprehensive institutional mechanisms for water management.

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

Analyzing Institutional Linkages to Performance

At the diagnostic phase of the study, all forms of institutions related to water resources development and management within the selected river basin are identified. Performance of the management system will be assessed in relation to this existing institutional framework. Subsequently, once areas for performance improvement and the scope of possible improvements are identified, another level of institutional analysis will be necessary to identify improvements to be effected to the existing institutional framework.

Five main external factors can be identified as either constraints or enabling situations that affect the water management institutions in a river basin. The overall political system and national economic policies play a significant role in fashioning the institutional framework for any given social context, and the river basin which is embedded in that context are naturally affected by these two external factors. Similarly, the overall legal framework and the general "law and order" situation in a country, particularly the social conditions that determine how the laws and rules are applied and adjudicated have a significant effect on water management institutions.

In some instances, the culture, traditions and practices inhibit the effective functioning of water management institutions, whereas, in some other instances, they tend to promote them. In order to asses the actual impact of these external influences, it is useful to have an understanding about the social conditions, traditions and practices in the given context.

Another important determinant of water management institutions in a river basin would be the physical system and the resource base in the basin. The nature of infrastructure, water availability and even soil conditions can play a role in the functioning of the institutional framework.

Based on this information, a more detailed study will have to be conducted on the key institutions including water laws, water policies, water allocation rules and practices, water-related organizations and their internal rules and procedures. Appendix 3 gives a check list that can be used in this analysis.

The final institutional analysis will primarily be aimed at identifying effective institutional arrangements for agricultural water management at three levels. At the macro-level or basin (or subbasin) level, analysis will deal with institutional arrangements that concern inter-sectoral allocation of water such as for irrigation, domestic water supply, hydropower, environmental purposes and other uses which depend on a common water source. The service level analysis will focus institutional issues relating to the multiple use of water within the irrigation service area. At this level, interest in other sub-sectors will only be to the extent that they affect agricultural water use either directly or indirectly. The use level analysis will center on institutional uses of water at the individual and farm-household levels.

Appendix 1

Checklist for Assessing the Existing Physical Resource Base

1. The Physical Domain

1.1. River network	units	
1.1.1. Length	km	.....
1.1.2. Catchment area	km^2	.....
1.1.3. Elevation (start)	m	.....
1.1.4. Elevation (end)	m	.....
1.1.5. Average annual discharge	mcm	.....
1.1.6. Maximum flow	m^3/s	.....
1.1.7. Minimum flow	m^3/s	.....
1.2. Climate		
1.2.1. Climatic zone		.....
1.2.2. Average annual rainfall	mm	.....
1.2.3. Annual average Eto	mm	.....
1.2.4. Maximum temperature	mm	.....
1.2.5. Minimum temperature	mm	.....
1.2.6. Number of dry months	No	.....
1.2.7. (< 5mm rainfall)		
1.3. Land use and agriculture		
1.3.1. Cultivated area		
1.3.2. Urban land area		
1.3.3. Grassland/Savannah		
1.3.4. Forest cover		
1.3.5. Area covered with water		
1.3.6. Irrigated land area		
1.3.7. Area under major crops		
1.3.7.1. Crop 1		
1.3.7.2. Crop 2.....		
1.3.7.3. (add).....		
1.3.8. Other (specify)		

2. Water Utilities

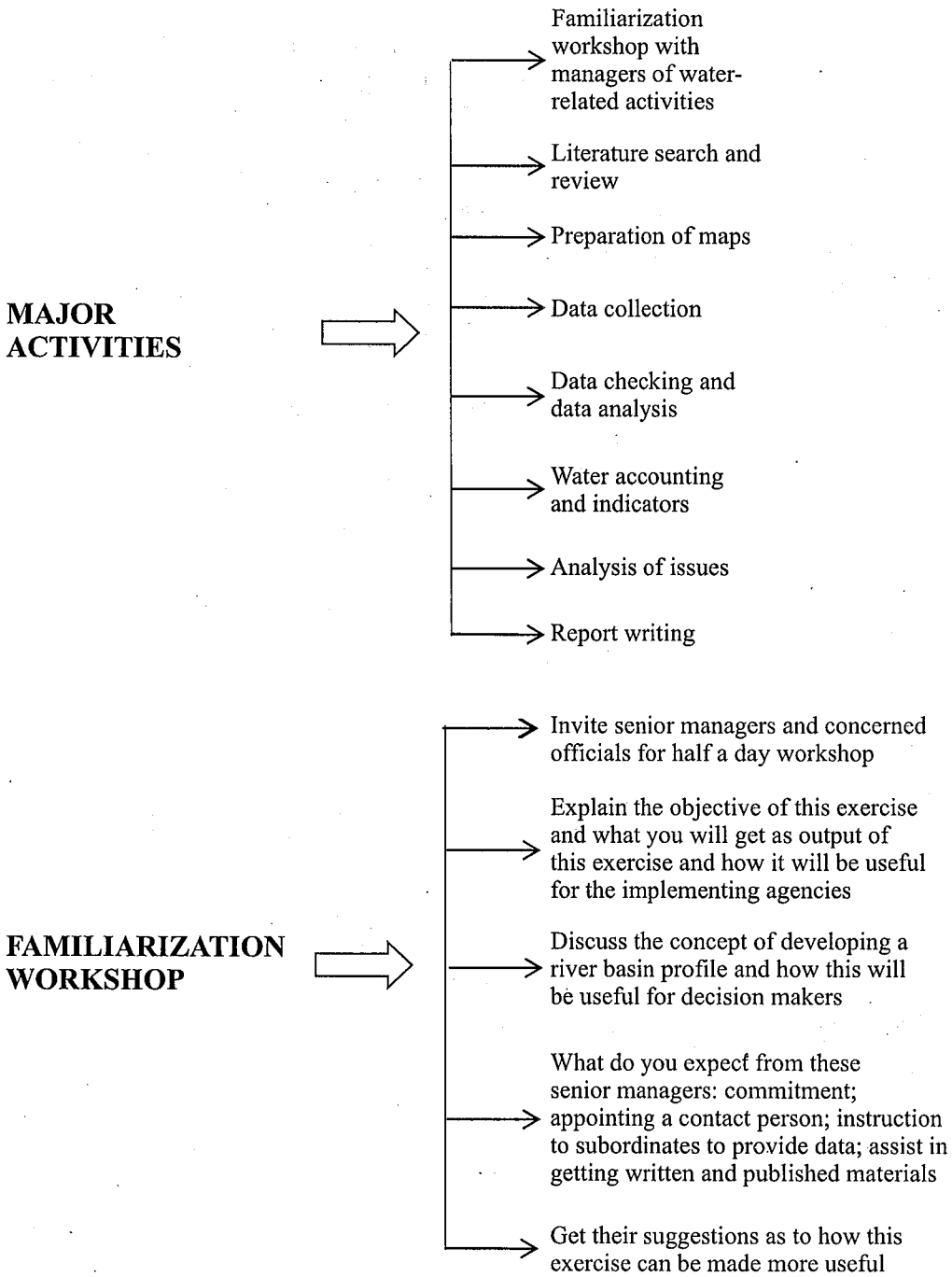
Type of utility	Number	Who owns utility	Who operates the utility	Legal Status of Operator
Surface irrigation systems	Example: 3	Example: Government	Example: Government agency = 1 WUAs = 2, etc.	Example: Govt. Department Local NGO – recognized by special law Local NGO – informal Private sector
Groundwater schemes				
Domestic water supply schemes				
Hydropower plants				
Wastewater treatment plants				
Others (add)				

3. Socioeconomic Profile

3.1. Total population
3.2. Population density
3.3. Number of urban centers
3.4. Number of villages
3.5. Total urban population
3.6. Total rural population
3.7. Urban households having piped water (%)
3.8. Rural household having piped water (%)
3.9. % employed in agriculture
3.10. Farm size distribution
3.11. Proportion of population living below official poverty line (define poverty line)

Appendix 2

Draft Guidelines for Computing Water Accounting in a Basin



LITERATURE SEARCH AND REVIEW

- Department libraries, statistical and yearbook; government archives, planning commission report, university publications, publications in seminar and workshop proceedings; local and national and international publications and planning departments at district, provincial and national levels
- Hydrometry, hydrometeororological, hydrogeological, land use, irrigated agriculture, drinking, industrial and environmental water use data
- Water resources potential (both groundwater and surface water)
- Water use (irrigation, hydropower, drinking, industrial, environmental)
- Water quality, pollution, treatment, reuse
- Floods, droughts, seawater intrusion, groundwater mining, soil erosion
- Water planning, institutions, water rights, water-related conflicts
- Prepare a bibliography and review

PREPARATION OF MAPS

- Decide about the scale (1:200,000 suggested)
- Basic map showing the administrative divisions (compute area covered by each administrative division)
- Soil map
- Land use map
- Hydrography map
- Groundwater aquifers and water table map
- Hydrometry network map

DATA COLLECTION

- Check number of working rain gauging (recording and nonrecording), pan evaporation, hydrometeorological and flow gauging stations and the period of record available
- Check groundwater observation wells, water table measurement, pumpage, etc.
- Prepare a data matrix with data description on the Y-axis and length of years of data available on the X-axis
- Decide about the length of data to be used in the analysis. (Please note that while selecting the data series, it should cover at least one wet, one normal and one dry year.)
- Collect data in the format to be provided and enter data in the computer
- Data collection is a long, tedious process. We must decide based on the matrix prepared, the no. of years that each item of data is to be collected and recorded
- It is always easier to collect the data if we identify a local person from the department where the data are to be collected and pay him/her a small honorarium

DATA CHECKING AND DATA ANALYSIS

- Scatter plot: identify outliers; corrections if any
- Double mass curve analysis
- Statistical analysis of data-distribution, statistical parameters
- Time series and trend analysis for resource availability and resource use (sector-wise)
- Analysis of floods, droughts
- Rainfall analysis, mean, variability, etc.
- Groundwater table analysis
- Storage potential created
- Surface water and groundwater use analysis
- Water quality data analysis

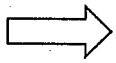
WATER ACCOUNTING AND INDICATORS

- Basin: identify closed, closing, open
- Develop: finger diagram
- Prepare finger diagram for a wet year, a normal year and a drought year
- Compute indicators: process fraction, depletion fraction (beneficial depletion, non-beneficial depletion); available water
- Compute productivity indicators
- Develop hydronomic zones
- Discuss water management practices in each hydronomic zone

ANALYSIS OF ISSUES

- Water scarcity
  - Water conservation measures
  - Increasing productivity
- Head-tail water supply problems
  - Identify reasons
- Water allocation among different sectors
  - Issues, conflicts
- Floods
  - Damages, flood mitigation
- Droughts
  - Drought proofing
- Hydropower generation
- Water quality and pollution
  - Issues and constraints
- Water pricing
  - Supply and demand management
- Water conflicts within the basin

REPORT WRITING



- Basin profile
- Introduction
- Basic description, including data collection network
- Method of data collection and checking
- Data analysis
- Discussion of results
- Issues
- Concluding remarks

Appendix 3

Checklist for Identifying the Existing Institutional Framework

1. Water Policies

1.1 Is there a sectoral prioritization of water? If yes, list the order of prioritization (irrigation, hydropower generation, environment, etc.), and quote relevant references.

1.2 What is the basis for such prioritization (economic, equity, resource consideration, etc.)?

1.3 What are the policies on financing of irrigation services and cost recovery?

1.4 Beneficiary participation in O&M of irrigation systems:
- 1.4.1. Policy on WUAs
- 1.4.2. Role and responsibilities of WUAs

1.5 Private sector participation

1.6 Policies relating to inter-sectoral water transfers

1.7 Policies relating to interbasin (regional) transfer

1.8 Informal arrangements for inter-sectoral water allocation and distribution

2. Water Laws

2.1 Existing legislation, rules and regulations concerning different sources of water (surface water, groundwater)

2.2 Existing legislation, rules and regulations concerning different uses of water (irrigation, domestic, industrial/commercial)

2.3 Present legislative linkages between water and water-related resources (land-groundwater, land-surface water, hydropower-irrigation, domestic water-irrigation, etc.)

2.4 Water rights
- 2.4.1. Basis for general rights in surface water
- 2.4.2. Basis for general rights in groundwater
- 2.4.3. Public vs. private control?

2.5 Existing legal instruments for ensuring the accountability of officials/water service providers and users

2.6 Legal provisions for water pollution control

2.7 Legal provisions/mechanisms for conflict resolution

3. Water Administration

3.1 How is the water administration organized spatially (i.e., basin level, water district, etc.) and how are they linked?

3.2 Explain the relative role and influence of government bodies in the water sector (i.e., Central Government, Federal/State/Provincial, Local Government Statutory Bodies/ Authorities)

3.3 List the agency/agencies managing each subsector (surface water, groundwater, domestic water supply, water quality, hydropower, etc.)

3.4 Describe the mechanisms for intra and inter-agency coordination

3.5 Current arrangements for water pricing and fee collection

3.6 Construct a responsibility matrix

3.7 Gaps in the exiting administrative setup

3.8 Describe the mechanisms for conflict resolution

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