

Water Institutions in India: Structure, Performance, and Change

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1. Introduction

With increasing water scarcity and frequent occurrence of water-related conflicts at macro and micro levels, the institutional arrangements governing water resource development, allocation, and management are receiving increasing policy attention worldwide. The water institutional arrangements assume, however, an enhanced significance in India as the country is moving fast towards the ultimate limit of its utilizable water resource potential. Although India is using only about 57 percent of its total water resource potential at present, it is already using about 66 percent of its irrigation potential [Government of India (GOI), 2000]. While water demand is increasing fast with a growing population and an expanding economy, further development of water resources is seriously constrained by investment bottlenecks, environmental concerns, and political and legal snags inherent in inter-regional water transfers. As the gap between projected demand and potential supply is likely to grow further, the physical scarcity of water, which is already visible in a few regions and cities, is expected to assume a national proportion in the not-too-distant future.

Unfortunately, most water institutions—being developed in an era of water surplus, especially during the colonial period—are becoming increasingly less relevant to address the water challenges as the country is entering in an era of absolute water scarcity. While Indian water institutions are undergoing significant changes in recent years, these changes fall far short of the new and emerging institutional requirements of the water sector. To see the magnitude and consequences of this reform gap, we need to first review the water institutional structure and then, attempt an evaluation of its efficacy and performance. Both the review of water institutional structure and the evaluation of its performance can be more illuminating when they are based on a conceptual and analytical framework based on the institutional decomposition approach. Similarly, the nature and direction of recent institutional changes as well as the factors behind these changes can be grasped better within a theoretical framework based on institutional transaction cost approach that accounts for both the economic and political transaction costs.

2. Objectives and Scope

The overall objective of this chapter is to review the historical evolution, present structure, functional performance, ongoing changes, and future direction of the water institutional arrangements in the particular context of India against a brief description of the water institutional environment within which the water institutional structure is embedded. This chapter attempts to realize its overall objective by addressing the following specific objectives:

- (a) outline the analytical framework and the theoretical approach being used to review water institutional structure and explain its evolution and change;
- (b) provide a brief description of the water institutional environment as characterized by the historical, socio-economic, political, and physical factors;
- (c) review the evolution, structure, and performance of water institutional arrangements, focusing first on the macro/formal institutional arrangements and then, on their micro/informal counterparts;
- (d) assess the performance of water institutions using few objective criteria;
- (e) evaluate the recent institutional changes within an institutional transaction cost framework and identify the forces—both endogenous and exogenous to the water sector—that determine the depth and direction of water institutional changes; and
- (f) conclude by identifying some major implications for theory and policy in the realm of water institutional reforms.

As to its focus and scope, this chapter is more eclectic rather than exhaustive in terms of its coverage of the legal, policy, and administrative or organizational aspects governing the water sector. The emphasis will be on the most important aspects of water institutions that are receiving considerable attention in the current debate on water sector reforms both in India and elsewhere. Such a selective coverage is necessary partly due to the need for a more focused analysis and partly due to the continental nature of India having a wider regional diversity in terms of both water institutional arrangements and water sector features. Nevertheless, as much as possible, region-specific aspects of both water institutional arrangements as well as water sector features will be highlighted in all relevant contexts. While informal institutional arrangements operating at the micro level will receive attention, the major focus will be on the formal institutional arrangements that are operating at the national and regional levels. This is because the formal macro-level institutions are more amenable for purposive reforms as compared to their informal and micro-level counterparts.

3. Analytical Framework

Institutions are entities defined by a configuration of legal, policy, and organizational rules, conventions, and practices that are structurally linked and operationally embedded within a well-specified environment. A simple analytical decomposition can enable us to have a better understanding of their nature and

features. From a very broad perspective, institutions can be decomposed by distinguishing the institutional structure (or, governance structure) from its institutional environment (or, governance framework) (Williamson, 1975; North, 1990a). While the institutional environment is characterized by the overall cultural, historic, socio-economic, and political milieu of a country or region, the institutional structure is defined by the interactive effects of legal, policy, and organizational or administrative components and their constituent aspects. Since the institutional structure is embedded within the institutional environment, the evolution of the former is invariably conditioned by changes in the latter. This does not mean that there is only one-way flow of effects between the two, as changing institutional structure also influences the institutional environment or governance framework.

Like all other institutions, water institutions also have their own institutional structure, as well as, their institutional environment (Saleth and Dinar, 1999 and 2003). The water institutional environment is characterized not only by the factors determining the overall institutional environment but also by those related to water resource conditions as well as to other water-related sectors such as agriculture, environment and forest, and urban development. The water institutional structure is defined interactively by three institutional components, i.e., water law, water policy, and water administration (or, water-related organizations). The institutional components cover not only the formal and macro-level arrangements but also the informal and micro-level arrangements such as those reflected in local customs, conventions, and informal contracts.

The formal *institutional components* (to some extent, their informal counterparts) can also be decomposed further to highlight some of their major *institutional aspects* (Saleth and Dinar, 1999 and 2003). For instance, water law can be decomposed to highlight: (a) inter-governmental responsibility, (b) water rights, and (c) accountability provisions and mechanisms. Similarly, water policy can be decomposed to shed light on: (a) project selection criteria, (b) pricing and cost recovery, and (c) user and private sector participation policy. In the same way, the organizational dimension of water sector can be decomposed to focus on: (a) organizational structure and the relative role of government layers, (b) financing and management, (c) regulatory mechanisms, and (d) conflict resolution arrangements. It is this institutional decomposition that we will use here as the analytical framework for the review and description of the water institutional structure in India. Two critical features of this analytical framework can be noted. First, although it is not that detailed and exhaustive, it still captures most of the institutional issues that are currently receiving wider attention both in national and global policy debates. Second, the decomposed institutional components and their constituent institutional aspects are treated as independent entities just for analytical convenience. In reality, the institutional aspects are functionally nested and interlinked both within and across the institutional components.¹

¹ For instance, within water law component, the aspects of water rights, conflict resolution, and accountability are interrelated as do the aspects of pricing, cost recovery, and user and private participation within water policy component. Since water policy is a political

The theoretical framework that we use here for explaining water institutional evolution and change is based on a simple representation of the institutional transaction cost theory (Coase, 1937; Williamson, 1975; North, 1990b) as attempted by Saleth and Dinar (2000 and 2003). In short, this framework identifies first all the major factors affecting water institutions and then, traces their effects on the transaction and opportunity costs of institutional reform. While the factors influencing water institutions are many and diverse, for analytical convenience, they can be grouped into endogenous factors that are internal to water sector and exogenous factors that are outside the strict confines of both water institution and water sector. The endogenous factors include water scarcity, water conflicts, financial and physical deterioration of water infrastructure, and operational inefficiency of water institutions. The exogenous factors include economic development, demographic growth, technical progress, economic and political reforms, international commitments and pressures, changing social values and ethos, and natural phenomena such as floods and droughts.²

Although it is difficult to isolate the individual effects of these exogenous and endogenous factors, it is still possible to track them, especially by conceptualizing their effects either in terms of the transaction costs or in terms of the opportunity costs. The transaction costs cover both the real and monetary costs of instituting and changing the regulatory, monitoring, and enforcement mechanisms related to water development, allocation, utilization, and management. The opportunity costs, on the other hand, cover both the real and economic value of opportunities foregone (i.e., the net social costs of inaction or '*status quo*'). The institutional transaction cost theory asserts that institutional change occurs whenever the opportunity costs exceed the transaction costs so as to give the much needed political economy thrust for reform.

The opportunity and transactions costs of institutional changes are not static but change continuously due to changes in factors both endogenous and exogenous to the water sector. For instance, as water scarcity becomes acute due to economic development and population growth, the real and economic costs of inappropriate water institutions tend to rise. Similarly, the economic reforms magnify the fiscal implications whereas natural calamities such as droughts and floods aggravate the political implications of the opportunity costs of institutional reforms. Political reforms involving nation-wide institutional changes, on the other hand, reduce the transaction costs of water sector reforms directly because the institutional changes within water sector form only a small part of the overall reform process. Likewise, technical progress can also reduce the transaction costs of institutional

translation of water law (or, water law is a legal translation of the policies that have attained political consensus or withstood the test of time) and water administration is the implementation arm for water law and water policy, these three institutional components are nested and linked both organically and operationally.

² Notice that it is these exogenous factors that together, in fact, characterize the overall institutional environment for the water institutional structure. As such, our analytical framework captures also the transaction cost implications of changing institutional environment that is characterized by both economic and non-economic factors.

changes. As the exogenous factors tend to magnify the opportunity costs of water crisis and reduce the transaction costs of water sector reforms, they often provide a powerful economic urge and political thrust for water institutional changes.

Institutional change is not a one-time event but rather a continuum involving gradual changes over time in response to the changing dynamics and relative magnitude and distribution of the reform costs and benefits. As the reforms initiated in earlier stages brighten the prospects for downstream reforms, there are intricate linkages between the transaction costs of subsequent reforms and the opportunity costs of earlier reforms.³ Similarly, since the institutional changes within water sector derive considerable synergy from exogenous factors that reflect changes elsewhere in the economy, the transaction costs of water sector reforms can also decline due to scale economies in institutional change.⁴ The opportunity and transaction costs implications of these dynamic and internal features of the institutional linkages and reform sequencing are an important and inherent part of the institutional transaction cost theory (Saleth and Dinar, 2003).

The institutional transaction cost theory, as outlined above, captures not only the role of factors both within and outside the water sector but also the strategic significance of certain dynamic aspects of institutional change such as institutional linkages and scale economies (Saleth and Dinar, 2003). Since it provides a unified framework to track and account for the effects of various factors affecting institutional changes in the water sector, this theory can indeed be used to explain both country-specific and cross-country variations in the nature and direction of water institutional changes. While the set of factors affecting water institutional change does not vary much across countries, their relative role and significance in the opportunity cost-transaction cost calculus can vary considerably across countries. It is the contextual nature of these variations that, in fact, explains why countries differ in terms of the extent and depth of water institutional reform observed both in the past and at present (Saleth and Dinar, 2000). It is this framework that we use here to explain water institutional changes in India.

4. Water Institutional Environment: An Overview

The institutional environment of water institutions in India can be characterized in terms of a synoptic overview of the country's history, constitutional framework, socio-economic conditions, political arrangements, and finally, the physical setting of the water sector itself. India has diverse cultural traditions and a rich his-

³ For instance, with the establishment of a transferable water rights system, the creation of other institutional aspects such as the conflict resolution mechanisms and water markets becomes easier due to the linkages that the transactions costs of the latter two institutional aspects have with those of the former.

⁴ The scale economies in transaction costs emerge from the fact that the cost of transacting water institutional changes is lower when water sector reform forms part of an overall country-wide economic reform (e.g., China) and political reconstruction (e.g., South Africa) than otherwise (Saleth and Dinar, 2000).

tory. Its present administrative and judicial systems have evolved through a long process involving a strong central Asian and Persian influence during the Mogul period and British influence during the colonial period. It is, however, the British who improved and perfected these diverse systems into a relatively uniform and a somewhat centralized administrative and judicial system. With the consolidation of centralized bureaucracy and the spread of market and commercialization, local and community-centered institutions have lost their relevance and gradually disappeared. The British influence can also be seen in the Indian political system characterized by multi-party democracy based on the parliamentary system. India has a federal form of government operating within a modern Constitution that demarcates the responsibilities of the central, state, and local governments.⁵

India covers an area of 3.29 million square kilometers and has a population of over a billion. Despite the constraints and burden imposed by heavy demographic pressure, Indian economy is able to grow annually around 5 percent with a per capita income of US\$ 450.⁶ Comparing the pre-independence situation with the present, India has shown a remarkable economic performance with the achievement of food self-sufficiency since the early 1970s and also self-reliance on most industrial products since the early 1980s. But, India is still largely a rural economy as two-thirds of the population still live in rural areas, though the rural areas themselves have undergone remarkable transformation in recent years, thanks to the expansion of transport and communication facilities. Rural poverty, which used to be as high as 56 percent during 1973-74, has declined to 39 percent during 1987-88 (Planning Commission, 1993:37-40). Currently, this figure hovers around 20 percent. Although the share of agriculture in the gross domestic product has declined now to 30 percent, this sector is critical both as a major source of employment (70 percent share in total employment) and as a key predicator of the pace and tempo of the overall macro economic performance itself.

Understandably, the water economy plays a critical role in the overall structure of the Indian economy. Being a vast and monsoon-dependent country, water resource potential displays severe spatial and temporal variations.⁷ From an aggregate perspective, the total water resource potential of the country is estimated to be about 1953 billion cubic meters (bcum), of which only 1122 bcum can be utilized under current economic and technological conditions. But, the actually developed resource at present is only about 644 bcum representing 57 percent of the utilizable potential. But, the total water requirement of the country is projected to be in the range of 694-710 bcum by the year 2010, 784-850 bcum by the year 2025, and

⁵ Although the central government is strong as per the Constitution, the state governments are becoming politically powerful in recent years due to the growing influence of regional parties both in state assemblies and in parliament.

⁶ When evaluated in terms of purchasing power parity, this per capita income is equivalent to about \$2150 (see World Bank, 2000: 274).

⁷ For instance, the average annual precipitation varies from 130 millimeters (mm) in Rajasthan desert to 11000 mm—the world's highest rainfall—in the Assam Mountains. Notably, three-fourths of the rainfall in India is received in just four months during June-September.

973-1180 bcum by the year 2050 (GOI, 2000). In view of such an increasing supply-demand gap, especially in the face of economic growth and demographic expansion, the per capita water availability, which has declined from about 5277 cubic meters (cum) in 1955 to 1970 cum at present, is likely to get depressed further. Although non-irrigation demand is likely to quadruple, the essentially rural and agricultural basis of the Indian economy will continue to orient the water sector essentially towards its irrigation sub-sector.

One key feature of the water sector with considerable institutional implications is the administrative demarcation of different water sub-sectors. While the canal irrigation sector is developed and managed by public agencies, the groundwater irrigation is developed and managed by millions of independent farmers.⁸ Groundwater irrigation is made possible by 9.8 million electric and 4.4 million diesel pumpsets that are fitted with some 5 million shallow/deep tubewells—located mainly in the Indo-Gangetic and deltaic regions—and 10 million dugwells—spread essentially in the hardrock region covering western and peninsular India. Besides, there are about 0.17 million surface water-based lifts located mostly in the deltaic regions of West Bengal and Orissa. On the other hand, water supply in urban and rural areas is largely managed by semi-autonomous water supply undertakings, municipalities, and local governments. Finally, institutions related to other resources involved in water resource development and utilization as well as those related to general economic and sectoral management also form part of the water institutional environment. These include the land, forest, and agriculture-related institutions (e.g., land tenure and tenancy, forest and environment acts, agricultural pricing policies, and trade policies and international agreements).

5. Water Institutional Structure: A Macro Perspective

For a more focused treatment, the review of the structure of formal and macro-level water institutions is organized within the analytical framework based on institutional decomposition. This framework distinguishes three institutional components, i.e., water law, water policy, and water administration, and highlights a few key institutional aspects under each of these three components. As noted already, the ensuing review is focused only on some of the key institutional aspects under each of these three institutional components.

5.1. Water Law

Water law assumes a central place in the functioning of water institutions as it gives the full legal backing to water policy as well as provides the operational

⁸ However, groundwater development is supported by government both directly in the form of public or state tubewells as well as indirectly in the form of credit support and massive investment in rural electrification programs.

framework and enforcing power for water administration including its regulatory arrangements. Although India does not have any separate and exclusive water law, water-related legal provisions are dispersed across various irrigation acts, central and state laws, constitutional provisions, court decisions, customary laws, and various penal and criminal procedure codes.⁹ Moreover, legal provisions in the case of land, forest, and environment also have significant implications for water resources. As most of these legal provisions were enacted in the past characterized by water surplus conditions, they fail to reflect the current conditions marked by water scarcity and water conflicts. Although there were some periodic, though marginal, changes in some of these provisions, especially during the post-independence period, they are too inadequate to develop the legal system suitable for meeting the emerging challenges within water sector.

5.1.1. Inter-governmental Responsibility

The legal provisions related to inter-governmental responsibility in the water sector are derived from the overall constitutional division of power between the central and state governments as effected by the Indian Constitution of 1952.¹⁰ As per Entry 17 in the State List under the Seventh Schedule of the Constitution, it is the states that have the jurisdiction over water resources within their borders. But, the powers of the states are subject to Entry 56 in the Union List that allows the central government to regulate and develop inter-state rivers and river valleys when this is declared by Parliament as a matter of public interest. The central government also has regulatory roles in the water sector vide Article 252 related to inter-state water projects as well as in terms of the Forest Conservation Act of 1980 requiring the states to get central clearance for executing ecologically sensitive water projects.

More importantly, the central government also has an important role in resolving inter-state water disputes as per the provisions under Article 262. It is in pursuance of this Article that the Parliament has enacted the Inter-state Water Disputes Act of 1956 and it is under this Act that a number of tribunals were set up to resolve water disputes among the states.¹¹ Besides, the Centre can also acquire legislative powers on water when two or more states desiring to have uniform water

⁹ Even though there are well conceived proposals for the unification and simplification of irrigation acts (e.g., Jacob and Mahesh, 1976) as well as for the creation of an exclusive but broad domain of water law (e.g., Singh, 1991 and 1992), they have not received their deserved attention from the policy-makers of India.

¹⁰ This constitutional division of power creates three lists of sectors/activities/jurisdictions, i.e., union list where the central government has exclusive power [Article 246(1)], state list where the state governments have exclusive powers [Article 246(2)], and concurrent list where both the central and state governments exercise powers [Article 246(3)].

¹¹ Since the Act has failed to specify the authority to implement the decision as well as the time limit for tribunal decision, it was amended twice: first in 1980 for authorizing the central government to establish the implementation authority and then, in 2002 to specify a six-year time limit for tribunal decision (Salman, 2002; Richards and Singh, 2002).

legislation request the union government with the approval of their respective assembly (Jacob and Singh, 1972). Despite these legal provisions as well as other administrative and financial leverages (that we will see later) of the central government, the final legislative powers are still with the states. While this arrangement is good to address state-specific concerns, there are also serious problems as the central government is unable to provide the kind of leadership and guidance needed for reforming the legal and institutional basis of the water sector both at the national and state levels.

5.1.2. Water Rights

The issue of water rights as a mechanism for allocation and accountability assumes importance with increasing scarcity and conflicts both at the macro-level of regions and sectors as well as at the micro-level of distributaries, communities, and individual users. Unfortunately, India does not have any explicit legal framework specifying water rights, even though various acts have some basis for defining some form of such rights. British legislation in India during 1859-77 recognized the customary water rights of individuals and groups. But, a radical shift occurred with the Easement Act of 1882 that made all rivers and lakes the absolute right of the state.¹² While state's absolute rights can affect the development and managerial aspects of water, from the perspective of water use and its equity effects, it is the *de facto* control over water by actual users at the micro-level that is more important.

Individual rights to both surface water and groundwater are recognized only indirectly through land rights. Thanks to the 'dominant heritage' principle implied in the Transfer of Property Act IV of 1882 and the Land Acquisition Act of 1894, a land owner can have a right to groundwater as it is considered an easement connected to the dominant heritage, i.e., land.¹³ In the case of canal water, the rights to access are limited to only those having access to land in canal command areas and these rights are only use rights and not ownership rights because irrigation acts do not allow the moving of canal water to non-canal areas. Under conditions of unequal land ownership and income pattern, the practice of linking water indirectly with land and the fact of *de facto* control by better endowed persons only accentuates rural inequality and water use inefficiency.

The Model Groundwater (Control and Regulation) Bill of 1992, which was formulated and circulated by the central government for the consideration of states, though postulates a kind of groundwater permit system, it fails to set with-

¹² This position got consolidated further with the Madhya Pradesh Irrigation Act of 1931 and also had its shadow over subsequent irrigation and water supply acts enacted even in the post-Independence period. But, a number of public interest litigations have led both the Madras High Court in 1936 and the Bombay High Court in 1979 to declare that government's sovereign rights do not amount to absolute rights (Singh, 1991).

¹³ As we will see later, this provision not only constrains groundwater markets, which have merged spontaneously in many parts of India, where water is sold apart from land but also excludes those without land to have any access to groundwater.

drawal limits (GOI, 1992a). While the Bill did induce some legal initiatives in states like Karnataka, Maharashtra, and Tamil Nadu, it has not received any serious consideration by other states, even though the Bill was circulated again among the states in 1997. In view of the absence of any significant reform initiatives, the legal aspects governing groundwater resources continue to remain largely divorced from both resource realities and economic requirements (Jain, 1976). Thus, the control over groundwater at the field level is governed by a *de facto* system of rights as determined by farm size, the depth and number of wells, pumping capacity, and economic power.

5.1.3. Accountability Provisions and Mechanisms

The two-way accountability, i.e., the individuals' accountability to each other and to the state, and *vice versa* could not be operationalized until a legal rights system is defined in the first place (Singh, 1992:8). When law defines individual water rights, in effect, it defines not only the legal boundaries but also the physical and economic boundaries of each individual's acts and their effects on others in the context of water use. By relating rights with duties, such boundaries could be legally handled with a reasonable quantification. Thus, individual water rights system helps to trace externalities, assign payment responsibilities, minimize inter-personal conflicts, and achieve the legally grounded notion of two-way accountability. Equally important is also the issue of accountability of executives and officials to the state and the people. As most irrigation and water-related acts in India have indemnity clauses to protect the executives against the consequences of wrong or non-implementation of stated policies, they do not provide enough incentives for the executives to be accountable either to the government or to the resource users.

The accountability of the users is sought to be influenced by negative but indirect provisions evident in penal codes and other civil/criminal procedures (Singh, 1991). While some of these provisions can be used to penalize users for acts such as non-payment of water charges or illegal water diversions, there are no corresponding provisions for penalizing officials for their failure to supply water at the right time or in needed quantity.¹⁴ Although legal provisions are necessary to infuse accountability and responsibility, they are not sufficient as their operational effectiveness depends on the kind of accountability mechanisms postulated within water laws. The accountability mechanisms currently available are both formal such as statutory, legislative, and judiciary-based mechanisms as well as informal such as decentralized and people-oriented mechanisms (Devi, 1992). Of them, while the formal mechanisms are costly in terms of both money and time, the informal mechanisms such as water user associations (WUAs) and stakeholder-based basin organizations—being more accessible and responsive—could ensure accountability and dispute-resolution with least cost.

¹⁴ The poor recovery of water charges and illegal uses of water observed widely in many parts of India clearly suggest that these provisions against users are ineffective because they are seldom used for various political and practical reasons.

5.2. Water Policy

Water policy relates to the declared statements as well as the intended approaches of the central and state governments for water resource planning, development, allocation, and management. It includes statements not only on the overall policy framework but also on specific policy issues such as project selection, water pricing and cost recovery, and user and private participation. Notably, since both the general and specific policies within the water sector are also influenced often by other sectoral policies related to agriculture, public finance, and basic needs, the former cannot be dealt with in isolation of the latter. For instance, the need for attaining food self-sufficiency and consolidating the productivity gains from Green Revolution has led to the implementation of large irrigation projects, rural electrification programs, liberal credit policies, and heavy irrigation, power, and credit subsidies. Moreover, political considerations, macro-economic necessities, and environmental concerns including natural calamities (e.g., floods and drought) also have a strong influence on water sector policies.

5.2.1. National Water Policy

Although the need for a national level policy for the water sector was felt for quite some time, the immediate factor that prompted the National Water Policy (NWP) of 1987 was the unprecedented drought of 1987. The main goals of the NWP are the promotion of conjunctive use of water from surface and sub-surface sources, supplemental irrigation, and water-conserving crop pattern and irrigation and production technologies (GOI, 1987). It has called for raising the canal water rates and promoting user participation in canal management. While the diagnosis of the NWP is right, its prescriptions fail to address the serious economic and institutional vacuum within which the water sector is operating. Although the NWP has recognized the need to limit individual and collective water withdrawals, it has failed to identify the institutional mechanisms necessary for defining and enforcing such physical limits. Unfortunately, the new NWP declared in 2002 has also failed to address the economic and institutional issues as it is almost a repeat of its old version, except for the recognition of the role of private sector participation and the need for a paradigmatic shift from water development to performance improvement (GOI, 2002). On similar lines, several states (e.g., Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu, and Uttar Pradesh) have also come out with their own water policy statements.

5.2.2. Project Selection Criteria

During the pre-Independence period, since the British treated irrigation projects as purely a commercial proposition, project selection policy was based on the Internal Rate of Return (IRR) criterion.¹⁵ After Independence, there was a shift in

¹⁵ The actually used IRR was also based on the prevailing rate of interest in the London money market as irrigation investments were often made from borrowed funds. As a re-

approach. Instead of a purely commercial approach, irrigation projects were viewed as instruments for fostering socio-economic development, especially by augmenting income, employment, and food production. Consequently, the IRR, which was initially lowered to 3.9 percent in 1949, was altogether abandoned in 1958 and in its place, a rather liberal benefit-cost ratio (BCR) was used as the project selection criterion. While the Gadgil Committee of 1964 recommended a BCR of 1.5, the Irrigation Commission of 1972 (GOI, 1972) allowed a BCR of just 1 for projects in drought-prone areas. However, in 1983, following the suggestion of the Public Accounts Committee, the BCR was replaced by IRR as the project selection criterion and the accepted IRR was 7 percent for projects in drought-prone and water-scarce years and 9 percent for others. Admittedly, while the reinstatement of IRR is welcome, the minimum levels stipulated are still far lower than the prevailing interest rate of about 10 percent.

5.2.3. Cost Recovery Policy

As to the cost recovery policy in the context of irrigation projects, successive Finance Commissions since the Fifth one have insisted on the recovery of not only the full operation and maintenance (O&M) expenses, but also a proportion of the interest on irrigation investment. While the Fifth Finance Commission suggested this proportion to be 2.5 percent, the two subsequent Commissions have lowered this to just one percent. Although the Eighth and Ninth Finance Commissions were satisfied just with the recovery of only the O&M costs, the Tenth Finance Commission reverted back to the stance of the Sixth and Seventh Finance Commissions, i.e., the recovery of full O&M costs plus one percent capital costs. This kind of cost recovery policy has also been supported by the Irrigation Commission in 1972, the Jakhade Committee in 1987, and the Committee on Pricing Irrigation Water in 1992. Unfortunately, the recovery policy, despite its widespread approval, was never implemented as it involves not only an upward revision in water rates but also a radical change in the very method for determining them.

5.2.4. Water Pricing Policy

While poor financial performance led to the recognition of the need for revising water rates, political pressure led to a delay in implementation. The main reason why farmers resist higher water rates is the general perception of water as a public good. But, the 1972 Irrigation Commission has articulated, for the first time since Independence, the private good characteristics of canal water. The Commission has also suggested that water rates have to be revised to cover, at least, 5 percent of gross income in the case of food crops and 12 percent in the case of commercial crops (GOI, 1972). Despite the recommendation of this and several subsequent commissions and committees, the water charges actually recovered from farmers continue to form only a fraction of both water productivity (i.e., the difference be-

sult, the IRR was also periodically revised, i.e., from 4 percent till 1919 to 5 percent during 1919-21 and to 6 percent after 1921 (Sangal, 1991).

tween the productivity levels of irrigated and rainfed lands) and actual O&M costs.¹⁶

While the cost recovery role of water pricing policy was emphasized by many expert groups and statutory committees, the Jakhade Committee of 1987 has underlined the resource use efficiency function of water pricing policy. The Committee has suggested that the method and level of water rates that capture and convey scarcity value of the resource can both induce efficiency and ensure full cost recovery. Although many states (e.g., Andhra Pradesh, Karnataka, Madhya Pradesh, and Tamil Nadu) have recently revised water rates up to three times, the present level and the method of fixing water rates are still unable to play these dual roles. These dual roles cannot be expected unless water pricing policy forms part of an institutional and technical arrangement needed for facilitating volumetric distribution, group-based allocation, and local management (GOI, 1992b; Salath, 1996).¹⁷

5.2.5. User Participation and Privatization

The policy towards user participation in irrigation management has evolved since 1974 when the Command Area Development (CAD) program was initiated to hasten the utilization of the created irrigation potential through farmers' cooperation. User participation under the CAD program was ephemeral and ineffective due to the paternalistic and *ad hoc* attitude of the bureaucracy. But, the financial crisis and physical deterioration of the irrigation systems have forced the irrigation agencies to consider farmer groups as indispensable partners in irrigation management. As a result, farmers' role in outlet level water allocation, fee collection, and system maintenance was recognized and the policy of 'turning-over' the system below the outlet level was accepted in principle and also practiced with varying degree of success (see Brewer, *et al.*, 1999). But, the major change in user participation policy occurred with the large-scale turn-over program of canal irrigation systems in Andhra Pradesh and Madhya Pradesh. To facilitate this, these states have also amended their irrigation acts by passing special acts. In many new and upcoming projects such as the Narmada and Sardar Sarovar projects, it is categorically specified that water will be distributed only to organized WUAs.

The attention on private sector participation in the water sector has been an outcome of factors such as declining irrigation investment, poor financial performance of water projects, and the privatization of public sector enterprises initiated since the New Economic Policy of 1991. In 1995, the Union Ministry of Water Resources has constituted a high level Committee to look into the legal, economic,

¹⁶ Recovered water charges, as a proportion of O&M costs, vary from 4.02 percent in Uttar Pradesh to 73.33 percent in Orissa, whereas the same as a proportion of water productivity vary from 0.28 percent in West Bengal to 5.19 percent in Maharashtra (GOI, 1992b).

¹⁷ Volumetric allocation is not new as it was tried twice—in 1854 and in 1917 in the Ganga Canal—during the British period. Although the idea was abandoned because of its impracticality under the technology of that time, it has received periodic attention also during the post-independence period, especially since the Taxation Enquiry Committee of 1953.

and technical questions related to the privatization of public irrigation projects. This committee has submitted a report favoring a gradual, selective, and stage-wise process of privatization of the irrigation sector (GOI, 1995). Similarly, the state government of Madhya Pradesh constituted a committee to look into the issue of sharing the primary benefits (water supply) and secondary benefits (power generation, tourism, aquaculture, and horticulture) between the government and the private parties involved in project construction and management. This committee has recommended that the primary benefits should be retained by the government but the secondary benefits can be given to private investors (GOI, 1995:135).¹⁸ The NWP of 2002, as approved by all states, has, in fact, encouraged the reliance on private corporate sector as a potential partner for water resources development.

5.3. Water Administration

Water administration covers the organizational, financial, and managerial structures including the regulatory apparatus and conflict resolution mechanisms, which are directly connected to the water sector. Despite considerable variations in the name and structure of water administration across states, there are a few common features such as centralized and bureaucratic character, dispersed organizational responsibilities, and weak functional linkages. Some of these shared traits become apparent as we review the overall structure of water administration.

5.3.1. Organizational Framework

The general organizational framework of Indian water sector can be briefly described by highlighting the key actors playing different roles both at the centre and in the states. The Union Ministry of Water Resources (MOWR), which itself evolved from the erstwhile Department of irrigation under the Union Ministry of Agriculture, is the national organization that is responsible for the overall planning and management of the water resources in the country. The Central Water Commission (CWC), the Central Groundwater Board, and the National Water Development Agency—all under the MOWR—provide overall technical support. Research and training supports are provided by organizations such as Water and Land Management Institutes (name differs in some states), agricultural universities, and other research institutions. The Planning Commission at the national level provides the project clearance and approves the financial allocation to various water projects in different states. Other central agencies influencing the water sector, in one way or the other, include the ministries of economic affairs, agriculture and rural development, environment and forests, housing and urban development, and health.

¹⁸ The terms of benefits offered by Maharashtra are still better as the government has allowed also a 6 percent share in total storage in addition to the full rights on all the secondary benefits (Saleth, 1997).

As noted already, the actual legislative and managerial responsibilities are with the public works, irrigation, or water resource departments at the state level. Usually, there are different departments to handle the groundwater and surface water sectors in the case of most states. The main department handling the water sector also has its research and training facilities in the case of some states. There are also important organizational arrangements to achieve inter-state and centre-state coordination. These include not only various river boards charged with the responsibility of coordinating water allocation among the states in the context of a few important inter-state rivers¹⁹ but also the National Water Resources Council (NWRC) set up in 1983 and the National Water Board (NWB) set up in 1990. The NWRC is an important policy organ in the Indian water sector as it is the apex body chaired by the Prime Minister and includes the Union Minister of Water Resources and the chief ministers/lieutenant governors of all states and union territories. The NWB—considered as the executive arm of NWRC—is chaired by the secretary of the MOWR and includes the chief secretaries of all the states/union territories, secretaries of the concerned union ministries as well as the Chairman of CWC. Local governments such as municipalities and *panchayat* unions also play an important role in drinking water supply as do the user and stakeholder groups in the irrigation sector. Pollution control boards operating usually under the ministry of environment and forests both at the centre and in the states have the responsibility for water quality aspects.

5.3.2. Financing and Management

Since water is a state subject, it is the states that are responsible for the financing, cost recovery, and management of all irrigation and water supply-related activities within their territory. They finance water development schemes from their own revenue, their share from the centrally collected revenue proceeds, and borrowings from financial institutions both within and outside the country. In recent years, some states such as Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, and Uttar Pradesh are also trying to mobilize funds from the private corporate sector as well as from the general public through deep-discount water bonds. As the cost recovery from irrigation and water supply projects is low and declining, many states are likely to rely more and more on private and public sources of funds. Even though the states have the major responsibility for water sector financing, the central government also plays a significant role by providing finance to states through central assistance, undertaking the construction of projects of national importance, and implementing centrally sponsored schemes such as the CAD program in canal regions. Besides, the central government also facilitates, approves, and allocates external loans and aids to irrigation and other water supply schemes through concerned ministries including the Ministry of Economic Affairs and the Planning Commission.

¹⁹ Since these river boards, which were created under the River Boards Act of 1956, are bureaucratic arrangements, they are not to be confused with the stakeholder-based river basin organizations that are being advocated in recent years.

Although the central government is responsible for the overall planning and coordination, it is the states that are responsible for the actual management of the water sector. The state water administration—known variously as the Irrigation Department, the Public Works Department, and the Water Resources Department in different states—is responsible for the construction, maintenance, and management of water projects. Regarding water pricing and cost recovery, the administrative systems differ in different states partly due to historical reasons.²⁰ Water administration in many states also has diffused or unclear administrative and functional responsibilities inapt for developing an integrated approach to water management. Since water management responsibilities are often with ministries dealing with public works, internal transport, or public health, they are linked with activities such as road construction and port management. But, the activities that are to be aligned such as surface water and groundwater management and irrigation and water supply provision are dispersed across departments or ministries. This problem is addressed only partially by the recent organizational reforms in states such as Andhra Pradesh, Haryana, Tamil Nadu, Orissa, Madhya Pradesh, and Uttar Pradesh. Despite the organizational reforms to the contrary, the spatial structure of water administration in most states is still based on administrative boundaries and projects rather than on well defined hydro-geological boundaries.

5.3.3. Regulatory Mechanisms

While India has a relatively sound technical information base and expertise in water-related aspects, their utility at the practical level of regulation is extremely limited due to the lack of organizational arrangements for enforcement and monitoring. The top-down approach inevitable in any centralized administrative set up and the attendant inability to tap locally available informal institutional potential (e.g., water-related local customs, water sharing conventions, and monitoring and enforcement mechanisms) constrain effective enforcement of even well-conceived policies. While well-spacing norm prohibits new wells within a radius of 200 m in most parts of India, the norm can be as high as 680 m in areas with deep tubewells and serious depletion (Shah, 1993:11). Similarly, there are also depth restrictions, especially for deep tubewells. For instance, in Gujarat, as per the Bombay Irrigation (Gujarat Amendment) Act of 1976 (1979), tubewell depth was limited to 45 meters (m), particularly for the Mehsana region. Later, the limit was not only raised to 100 m but also made applicable to most parts of Gujarat. Since these spacing and depth restrictions take effect only when a farmer applies for concessional loan/well permit/electric connection, they restrict mostly the poor farmers (Dhawan, 1990).

²⁰ For instance, in Haryana, Punjab, Uttar Pradesh, and West Bengal, the water rate assessment is done by the water-related department, whereas the collection is done by the revenue department. But, in Andhra Pradesh, Karnataka, Kerala, Orissa, and Tamil Nadu, both functions are performed by the revenue department. This administrative problem is due to the fact that in the case of most old irrigation projects of these states, there are no separate water charges, but only a higher land revenue assessment for irrigated lands.

While a restricted power supply policy provides some regulatory respite, it is of little consequence in the face of large pumps and multiple wells. The effectiveness of regulations based on power tariff and supply policies is severely undermined not only by the availability of the diesel pumpset option but also by the presence of a 'kink' in the farmers' power demand.²¹ Although groundwater markets are found to improve efficiency and equity in water use (Shah, 1993), they could, nevertheless, accentuate aquifer depletion under current legal and institutional regimes without water rights (i.e., legalized 'water quotas') (see Saleth, 1996). Thus, current legal and regulatory policies as well as these markets reinforce rather than regulate the *de facto* control of groundwater by resource-rich and influential farmers. In the case of surface water resources, neither the usual policies based on water charge/supply manipulation nor the new ones based on rotational water supply system are likely to generate sufficient impact effective enough to enforce discipline in canal water use. WUAs can certainly enhance cost recovery and improve system maintenance. However, they cannot generate incentives powerful enough to enhance water use efficiency unless they operate within the framework of a legally established but locally managed system of group and individual-specific water quotas.

5.3.4. Conflict Resolution Mechanisms

Various arrangements exist for resolving conflicts at different levels. Water use prioritization specified in the NWP and implied in the Constitution²² can provide a general framework for resolving inter-sectoral water allocation conflicts. But, for a more effective solution, quantification of entitlements is to accompany prioritization and both should be defined within appropriate hydro-geological and organizational contexts. Unfortunately, the issue of quantification of entitlements is often left to administrative or political decisions. The most preferred arrangement requires both the physical context of river basins and the organizational framework involving networks of stakeholders of those basins. In the case of inter-state (or inter-regional) water conflicts, the arrangement relied on often in the past involves negotiated agreements for developing and sharing water among the concerned states and regions.²³ But, when there is difficulty in reaching a negotiated settlement, then, the concerned parties can rely on the tribunal established by

²¹ The kink in power demand emerges from the fact that the gap between energy cost and the net value of output per unit of power is very high. As long as this gap is substantial and can also be manipulated by crop choice, farmers will not reduce power consumption and hence, their power demand will be insensitive to power tariff changes (Saleth, 1997).

²² For instance, the constitutional provisions relating to fundamental rights to life (and clean environment) are often used as a basis for assigning top priority for drinking and domestic uses as well as irrigation and ecological water needs.

²³ There are about 58 independent water-related agreements among states concluded in the past—39 related to joint projects and 19 related to sharing of river waters—and all of these are under heavy pressure for renegotiation due to the increasing water requirements of concerned parties.

the central government under the provisions of the Inter-state Water Disputes Act of 1956.²⁴

As the pressure for the renegotiation of existing agreements builds up with increasing water scarcity, the role of the tribunal mechanism is likely to increase in the future. Although the tribunal awards settle the dispute by quantifying the water claims, they involve a lengthy process to reach a final settlement. Even the six-year time limit specified by the 2002 amendment is too long. Besides, since the implementation of tribunal awards can be contested in the Supreme Court, it is crucial to provide legal binding to final awards. Although market or negotiation-based arrangements are not tried much in India, there is considerable potential for them. States can be encouraged to purchase and sell water either on a payment basis or on a barter basis (i.e., exchange of water for power or foodgrains). There are also cases such as the Krishna water transfer for Chennai (Madras) city where Tamil Nadu has paid for the entire project costs (implicitly paying for water).

As to the mechanisms for resolving water-related conflicts at the micro-level, there are a few traditional and informal village level institutions (e.g., tank-level organizations in Tamil Nadu). By rejuvenating these informal institutions as well as by strengthening the formal arrangements such as the *panchayat* institutions and WUAs, it is possible to build a more effective and accessible conflict resolution mechanisms at the grassroots level. However, the middle level conflicts across communities within a river basin or canal system (e.g., upstream users vs. downstream users) as well as the conflicts between irrigation and water supply agencies are still rampant for want of proper forums for resolving differences. The arrangements forming part of the bureaucracy (e.g., divisional engineer or district collector) not only remain inaccessible for all but also turn out to be artificial as free expression of mutual concerns becomes difficult. Basin or system level stakeholders' association involving user groups and officials can be a very useful forum for promoting both conflict resolution and accountability.

6. Water Institutional Structure: Micro Perspective

Although colonial policies as well as the post-colonial expansion of government bureaucracy have severely eroded most of the indigenous water institutions, India still presents a rich variety of locally managed water-related institutions, especially in the water-scarce areas of Bihar, Maharashtra, Rajasthan, and Himachal Pradesh (Datye and Patil, 1987; Sengupta, 1993). These institutions are in the form of informal customs and conventions for water sharing as well as community-based organizations for water management. Although these institutions remain

²⁴ Under this Act, the central government has so far set up five tribunals and three of them have come out with amicable decisions (Krishna in 1976, Godavari in 1979, and Narmada in 1979). These include also the tribunal dealing with the politically most sensitive Cauvery River dispute where only an interim award was given and even that is strongly contested by one of the concerned states.

largely independent of formal water institutions and operate only at the periphery of the formal water sector, they can still provide very valuable insights for designing the kind of institutional mechanisms that are needed for filling the organizational vacuum existing at lower echelons of water management. In addition to these traditional arrangements, new forms of informal arrangements for sharing water and irrigation service have also emerged in recent years, especially in the groundwater regions. They are the rental markets for irrigation assets, groundwater markets, and myriad forms of water contracts. As these informal institutions—both traditional and emerging ones—have significant implications for the operation and performance of formal institutions, they deserve our attention.

6.1. Localized Institutions

Even though the legal system in India has not formally specified any water rights system, there are evidences for the operation of rudimentary water rights systems capable of being developed into an effective water rights system. Informal water rights—both individual and group—have existed in India since ancient times (Siddiqui, 1992) and continue even today, albeit in a much weaker form, in many tank irrigation systems of South India (Vani, 1992). A few South Indian irrigation systems have informal and prioritised water rights not for individuals, but for different distributaries or command segments (Vaidyanathan, 1985:63-64). The 200-year old *Phad* system operating in the Panijhra River area of the Dhule district and the the *Pani Panchayat* system being practised in parts of Purandhar taluk of Pune district, Maharashtra (Datye and Patil, 1987:42-123) have the potential for creating a user-managed water rights system.²⁵

In the deltaic regions of Orissa and West Bengal as well as in parts of Bihar and Madhya Pradesh, there exists an officially-granted non-transferable long-term water lease system designed for encouraging farmers to use surface water (GOI, 1976:65). More important and interesting is the *Shejpali* (water distribution roster) system being practised in the canal commands of western Maharashtra. Under this system, the canal authorities issue 'water passes' on the basis of an application from farmers in the command on a 'first-come, first-serve' basis. The duration of these water passes varies from six years to a single crop season and their priority varies somewhat directly with their duration. That is, longer duration passes have seniority over shorter duration passes (Gandhi, 1981; Rath and Mitra, 1989). But for their non-transferability and quantitative specification, these water passes system resembles very closely the water permit system of the mid-western states of the US. Besides these relatively well-known systems, there are also a variety of informal organizational arrangements and water allocation conventions that can be observed both in the mountain and foothill regions and in the tank irrigated areas.

²⁵ Notably, under the *Pani Panchayat* system, the water share of users is based not on farm size but on water needs. Since water needs are calculated at about half an acre worth of irrigation water per person, the allocation criterion is divorced from land ownership, but linked closely with family size (Singh, 1991:35; Vani, 1992:9-10).

6.2. Rental Markets for Irrigation Assets

Increasing value of irrigation water as well as land and resource-related bottlenecks for private investment in irrigation assets have led to the emergence of the phenomenon of rental markets for irrigation assets such as wells and pumpsets.²⁶ Since these markets allow farmers to irrigate their farms by renting the irrigation assets from their neighbors, they contribute both to equity in water use and better utilization of irrigation assets. According to national sample survey information [National Sample Survey Organization (NSSO), 1984 and 1985], about 10 percent of the total pumpsets in the country are involved in pumpset rentals. Since about 63 percent of these rentals occur with dugwells/tubewells with electrically powered and permanently fitted pumps, it seems that the majority of the rentals involve water transfer as well. This is particularly so for the Indo-Gangetic and hardrock states. Since the rest of the rentals occur in the case of other water sources where pumps can be physically moved with little cost, it seems they occur independently of water transfers. This is particularly so in the deltaic states such as Bihar, Orissa, and West Bengal (Saleth and Thangaraj, 1993).

The expanding phenomenon of pumpset rentals is an indication of the existence of surplus pumping capacity, particularly in the case of diesel pumpsets. In condition where irrigation assets account for 16 percent of rural assets and up to 40 percent of private fixed capital formation in agriculture (Saleth and Thangaraj, 1993), the underutilization of irrigation assets is a serious issue. The informal institution of rental markets has emerged essentially as a response of the farmers to address this problem. This phenomenon also brings forth certain conceptual and institutional implications. For instance, when there is the physical movement of pumpsets from one water source or location to another, they are just pure pumpset rentals as there is no water transfer between farms.²⁷ But, in the hardrock and Indo-Gangetic regions where pumpsets—mostly electricity-based—are permanently installed with dugwells/tubewells, pumpset rentals necessarily involve water transfers and hence, the rental activity is institutionally linked with groundwater markets (Saleth, 1996).

6.3. Groundwater Markets

Despite their localized, fragmented, and uneven nature across regions, groundwater markets are growing in magnitude and gaining in significance. While water selling practices in India are traced to the 1920s, more systematic documentation

²⁶ This phenomenon involves the use of dugwells or tubewells and hence, the transfer of water in the case of lift irrigation in groundwater regions. But, in surface water-based lift irrigation systems where pumpsets can be physically moved from one farm to others with little cost, rentals can occur independent of the use of wells and hence, water transfers.

²⁷ In their survey of few West Bengal villages, Kolavalli and Atheeq (1990:26) report such pure pumpset rentals where diesel pumpsets are leased on a seasonal basis with the lease rate per crop season varying between Rs. 1200 and Rs. 1500.

of this phenomenon started only since the late 1960s. Their characteristic features are that they occur without any formal water rights system and involve no sacrifice of self-irrigation.²⁸ While there is no systematic national level study on the magnitude of water selling, based on his studies in Gujarat and Uttar Pradesh, Shah (1993:250) has projected the area irrigated through groundwater markets to be up to 50 percent of the total gross irrigated area under private lift irrigation. Understandably, there are considerable variations across regions. While the area irrigated through groundwater markets is projected to be up to 80 percent for north Gujarat (Shah, 1993:205), the corresponding figure for Uttar Pradesh is about 60 percent (Shankar, 1992:12). But, in Vaigai basin, Tamil Nadu, the area under purchased water was reckoned at no more than 30 percent of the total irrigated area (Janakarajan, 1993). In contrast, there are also studies which report no water selling at all in their respective sample areas (see Shah, 1993:55).

Coming to the dominant technical and institutional features of water markets, although their geographic locus is limited by the physical characteristics of the groundwater and farming systems, their size is often enlarged by elaborate underground pipeline networks. But, such market expansion is confined to very few regions and often leads to an unbalanced market structure as it adds more buyers than sellers to the market. Since buyers are mostly small farmers, they have a weak bargaining position. For instance, a typical water sale-purchase matrix in Uttar Pradesh reveals that the demand side is dominated by smaller farms with less than 2 acre as they account for 81 percent of the total area under purchased water (Shankar, 1992:33). In view of the monopolistic or oligopolistic tendencies in these markets, not only are water rates several times higher than the pumping cost, but also price and non-price discriminations remain pervasive. The root cause for the sub-optimality of these groundwater markets lies not so much in their economic and organizational aspects but in the legal and institutional vacuum within which they operate at present. As a legally instituted and locally managed water quota system defined within an ecologically consistent overall withdrawal limit can provide more powerful incentives for water use efficiency, it could eliminate their negative effects, but magnify their positive benefits (Saleth, 1996).

6.4. Water-Based Contracts and Conventions

There are a variety of water-based tenancy contracts. Although these contracts are often treated as part of groundwater markets, they need to be differentiated as they involve the use of other resources such as land, labor, capital, and other farm inputs that are governed by distinct sets other institutions. For instance, there are two distinct types of such contracts in Kheda district, Gujarat. They are: (a) a two-party contract where water sellers provide irrigation, share 50 percent of cash expenses (except labor costs), and claim 50 percent of output and (b) a three-party

²⁸ Under these conditions, there is not only a conceptual issue (i.e., whether the sellers are selling water or excess pumping capacity) but also an economic question (i.e., the opportunity costs are undefined when there is not sacrifice of self-irrigation).

contract where water seller, land owner, and laborer share equally the cash expenses as well as crop output (Shah, 1993:51-52). Similarly, in Karimnagar district, Andhra Pradesh, water sales occur within labor contracts, crop sharing contracts, and crop and input sharing contracts. Notice that these contracts represent not only an institutional evolution of crop sharing within the context of WMs but also link WMs with other rural input/output markets.

Apart from these water-based tenancy contracts, the pricing methods are also accompanied by certain informal conventions and contractual obligations with considerable implications for water use efficiency and risk-sharing (see Kolavalli and Atheeq, 1990:38-40). For instance, the area-based method involving crop shares, though provides lesser incentive for water conservation than the method involving hourly rates, allows risk-sharing between buyers and sellers and also involves some informal contractual obligation for sellers to provide irrigation for the whole season. Besides, in the case of both the area and per irrigation rates, there are also mutually agreed upon conventions (e.g., the level or intensity of irrigation constituting 'full irrigation') to avoid conflicts and water overuse. Since water sharing contracts also lead to input/output selling contracts, there are also evidences for inter-linked input and output markets in rural areas (Janakarajan, 1993).

7. Evaluating the Performance of Water Institutions

The overall performance of water institutions depends not only on the individual effectiveness of the legal, policy, and organizational components and their underlying institutional aspects but also on the joint performance as determined by the strength of the structural and functional linkages among these institutional components and aspects. Besides these internal and structural features, the performance of water institutions depends also on the general institutional environment within which they evolve and operate. While this perspective of evaluating water institutional performance is consistent with our institutional decomposition-based analytical framework, its empirical translation with objective information presents a major challenge. Nevertheless, this approach is amenable for empirical application when it is possible to use perception-based judgmental information collected from a carefully selected sample representing a cross-section of water sector stakeholders (Saleth and Dinar, 2003).

When perception-based data cannot be collected due to the lack of time and resources, another alternative could be the reliance on the learned and balanced judgements of the researchers themselves. The key aspect for consideration in this respect can be the overall progressiveness of water institutions as captured in terms of their adaptive capacity, amenability for innovation, openness for change, and ability to tackle emerging and future water sector challenges (Saleth and Dinar, 1999). As we reflect these criteria over our brief description of the structure of Indian water institutions both at the micro and macro levels, we can derive few general and qualitative results. For instance, we see the micro-level

institutions (e.g., groundwater markets) are relatively more responsive to changing local needs whereas macro-level institutions continue to lack the required extent of flexibility as changes are resisted by factors ranging from path dependency to political economy obstacles. Even within formal institutional components, water policy is relatively more responsive as compared to water law and water administration. The policy changes (e.g., water policy statements by the national and a few state governments) are mostly in the nature of a political expression of intentions and aspirations rather than leading to practical attempts for the implementation of the stated policies. As a result, they are politically easy to accomplish, but operationally ineffective in ensuring the intended socio-economic benefits. But, policies related to more substantive aspects such as water pricing and inter-regional water transfers have not changed much. Similarly, in the sphere of water administration, the changes such as the administrative reorganizations are mostly superficial whereas substantive aspects such as the oversized and functionally unbalanced staffing pattern, creation of basin organizations, and making water-related departments financially autonomous have not changed to the desired extent.

From another perspective, water sector performance can also be used as a proxy for understanding water institutional performance. While the performance criteria applicable at the project and system levels are relatively more rigorous (e.g., Bos, 1997; Burt and Styles, 1997), those needed for evaluating the performance of water sector as a whole are more indicative rather than conclusive.²⁹ Recognizing this fact, we follow a simple yet meaningful approach of evaluating the overall performance of Indian water sector in terms of three gaps: the physical gap, financial gap, and economic/incentive gap (Saleth, 1996). The physical gap can be evaluated in terms of both the gap between water resource potential and its utilization as well as the gap between water demand and supply. The financial gap can be indicated in terms of the gap between water sector investment and cost recovery. Similarly, the economic/incentive gap can be reckoned in terms of the gap between the average value of water and the water rate being charged. Finally, we note that these three gaps are evaluated essentially in the particular case of irrigation sub-sector that uses up to 80 percent of total water withdrawals.

The utilization gap is already indicated in an earlier section as part of our discussion on water institutional environment. The demand-supply gap that which has already assumed serious proportions at local and regional contexts (e.g., Cauvery Basin, in southern India) is also growing at the aggregate level. In the particular context of irrigation sub-sector, the demand gap is very serious as the actual irrigation potential created so far is only about 88 million hectare (mha) as

²⁹ Even with well-developed objective performance criteria, water sector performance cannot be evaluated in all its dimensions due to the presence of crucial subjective aspects of performance such as the smoothness of water transfers and the adaptive ability of water institution. While proxies like the number of water sector conflicts can be used to capture this aspect, it is not clear, for instance, how one can factor into the evaluation the relative seriousness of such conflicts. Despite these problems, we can evaluate.

against the gross sown area of 185 mha.³⁰ The problem is going to be complicated further by the declining share of irrigation caused by the increasing demand pressures from other water sub-sectors. From the perspective of institutional performance what all these forms of physical gaps suggest is the fact that current institutions, particularly those related to inter-basin transfers, inter-sectoral allocations, and conflict resolution, are weak requiring urgent reforms.

The financial gap in the water sector can be approximated by the difference between the total investment costs and total revenue in the canal irrigation sector. The total investment in canal irrigation during 1951-2000 is estimated to be Rs. 790 billion at current prices (GOI, 2000). Even if we assume a simple rate of 8 percent to account for both interest and depreciation, the annual financial cost of canal irrigation provision comes to about Rs. 63 billion. Although we do not have published information on the revenue from canal sector, going by the estimate of the Committee on Pricing Irrigation water (GOI, 1992b), we can reckon that the total revenue at present can be in the range of about Rs. 3-5 billion. Such a magnitude of financial gap clearly shows that the institutional aspects such as cost recovery and water pricing policies as well as the organizational mechanisms involved in water charge collection are performing rather poorly.

Since the economic/incentive gap shows the extent that water charges remain below the economic value of water, it is clearly linked with the financial gap, especially water pricing and cost recovery policies. Water rates are not only very low but also rarely revised. As a result, they are related neither to productivity nor to provision cost. They cover hardly 5 percent of water productivity (i.e., the difference between the average productivity levels of irrigated and rainfed lands) and 8 percent of O&M costs. Paradoxically, since even the low water charges are not fully recovered, the arrears are also accumulating over time in most states. Besides these effects on the financial side, the low and uneconomic water rates also lead to an incentive problem causing widespread water use inefficiency. The incentive gap can be approximated by the gap among water productivity, supply cost, and water rates. In the context of canal regions, while water productivity is reckoned in the range of Rs. 714-5812/hectare (ha) and supply cost is estimated to be in the range of Rs. 90-603/ha, water rates were in the range of Rs. 6-1000/ha (GOI, 1992b). The incentive gap indicates not just the poor performance of pricing and cost recovery policies but also the absence of institutional conditions necessary for volumetric allocation such as the water rights including their legal and organizational requirements.

8. Institutional Change: Nature, Extent, and Causes

The review of water institutional structure clearly shows that legislative powers, technical capabilities, planning skills, and operational responsibilities are

³⁰ Even if the estimated ultimate irrigation potential of 139 mha is fully developed, India will still continue to have this irrigation gap as the gross sown area is expected to grow further to 210 mha by 2025.

dispersed across government layers. As a result, water institutions in India remain legally weak, functionally disjoint, and regionally uncoordinated. While the physical stress, financial crisis, and performance gaps have clearly exposed the legal, policy, and administrative weakness of water sector, myopic political issues and administrative resistance continue to delay the implementation of the reform blueprint developed jointly by the GOI and the World Bank (World Bank, 1998). This does not mean that there are no changes in the institutional sphere both at the central and state levels.

8.1. Nature and Extent of Changes

At the national level, the central government has constituted a number of national committees/commissions to review specific water policy issues as well as plan for the long-term development of the water sector. Among them, the notable ones are the Committee on Pricing Irrigation Water (1992), Committee on Private Sector Participation in Major and Medium Irrigation Projects (1995), and the National Commission of Integrated water Resources Development Plan (1997). While the first one has revived the attention on the rationalization of water rates, volumetric water allocation, and system modification, the second one has documented the rationale, feasibility, and actual state level initiatives for involving private corporate sector, especially in the construction and modernization of irrigation schemes. The National commission has developed a national master plan for the water sector by synthesizing and updating similar plans prepared earlier by the CWC as well as investigated the economic, technical, and institutional issues in the water sector from a national perspective.

Although these three initiatives seem to be like any other routine committees/commissions, they are a very important part of the long process of water sector reforms in India. In fact, some of their suggestions are reflected in the new NWP declared in 2002 with the consensus and approval of all states. It is true that its final version is a substantially watered down version drafted in 1999 in view of the reservations of some states, especially on statements related to water sharing. But, it also signifies a consensus on two important policy issues that represent a somewhat radical departure from the past. These relate to the agreement on private sector participation in water resource development and on the need for a paradigmatic shift from water resources development to their allocation and management.

Besides the new NWP, there are also notable changes on the legal front—some initiated by the central government and others by public interest litigations by concerned individuals/groups. To avoid the usual delay in tribunal decisions, the Inter-state Water Disputes Act of 1956 was amended in 2002 for mandating a six-year limit for the tribunal to give its final award. While this amendment helps to reduce the usual time involved in tribunal decisions, the gravity of some water disputes (e.g., Cauvery water dispute) necessitates not only a much shorter time for tribunal decisions, but also a different organizational arrangement for resolving conflicts. It is for this reason that the Cauvery River Water Authority—a new

kind of institutional arrangement for dealing with inter-state water disputes—has been created to deal with the water allocation conflict among the four states in the Cauvery River basin.³¹ While public interest litigations have invoked the Supreme Court to order the closer/relocation of many polluting industries on the banks of Yamuna and Ganges rivers, presidential intervention has invoked the same to order the central government to investigate the feasibility of linking major rivers.³²

At the state level, there are also noteworthy changes, especially in the case of Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, and Uttar Pradesh. These changes can be seen both in the organizational spheres (e.g., administrative reorganizations including the creation of basin organizations in states such as Tamil Nadu and Uttar Pradesh) as well as in the policy spheres (e.g., declaration of water policy statements by most states). There are also more substantive changes in a few states. For instance, Andhra Pradesh and Madhya Pradesh have gone for a statewide program for the transfer of the management responsibilities of almost all canal irrigation below the outlet and minor levels.³³ Notably, such transfers occurred with full legal backing under specifically enacted legislations. With the transfer of irrigation management responsibilities and the organization of regular elections and training to the office-bearers of WUAs, these states could see farmers accepting an increase in water charges up to three times and undertaking cost recovery and maintenance functions. Although irrigation management transfer in other states was not of that magnitude observed in these two states, they demonstrate both policy commitments and concrete actions for the devolution of allocation, cost recovery, and maintenance functions to WUAs.

Another important change at the state levels pertain to the creation of autonomous corporations by Karnataka and Maharashtra for mobilizing public funds as well as the initiatives of Andhra Pradesh, Gujarat, Madhya Pradesh, and Maharashtra for soliciting corporate investments in the water sector. In 1994, Karnataka has formed the Krishna Bhagya Jal Nigam Limited (KBJNL) under the Companies Act with the specific purpose for mobilizing public funds for developing the Upper Krishna Project. Thanks to the high return (about 17.5 percent) and government guarantee, the water bonds issued by the KBJNL during 1995-99 have fetched an unexpected sum of Rs. 23 billion.³⁴ Almost similar is also the case with the Maharashtra Krishna Valley Development Corporation (MKVDC)

³¹ This entity—patterned after the Murray-Darling River Basin Organization of Australia—is unique in Indian context as this is the first time that a basin organization is chaired by the Prime Minister with the chief ministers of all the concerned states as members.

³² This inter-basin transfer scheme—popularly described as the ‘Garland Scheme’—has been proposed for a longtime not just by engineers and politicians but even by poets and other social thinkers.

³³ For instance, under its Farmers’ Participation in Irrigation Management Act of 1999, Madhya Pradesh has transferred outlet management responsibilities of all surface irrigation schemes to 1470 legally constituted and formally elected WUAs—466 in major, 158 in medium, and 846 in minor schemes.

³⁴ Since a high credit rating of these bonds has led to over-subscription, the KBJNL has revised down the return to only 14.25 percent in July 1998.

floated by Maharashtra in 1996. The water bonds of MKVDC also promise a 17.5 percent return payable half-yearly with a maturity period of six years for the first 50 percent of the value and seven years for the remaining 50 percent of the value. Besides, these bonds also allow an up-front discount of 2.5 percent of their face value. As a result, the first public issue of MKVDC undertaken in July 1996 has fetched an amount of Rs. 4.28 billion as against the original target of only Rs. 1.5 billion. Encouraged by the overwhelming response, the Maharashtra government has plans to mobilize over Rs. 36 billion through MKVDC (Saleth, 1999).

In addition to its efforts through MKVDC, the government of Maharashtra is also trying to tap direct investment from the private corporate sector. For instance, in 1996, it has invited private bids for 52 irrigation projects worth Rs. 150 billion. On similar lines, the governments of Andhra Pradesh, Gujarat, and Madhya Pradesh have also tried to tap the private sector both for the construction and modernization of few water projects (GOI, 1995). Interestingly, in its Agricultural Policy Resolution of 1995, the Government of Karnataka (GOK) has indicated its willingness to grant financial autonomy to the irrigation department by converting it into a corporation and making the farmers co-owners of the irrigation structure with 'water equity shares' (GOK, 1995).³⁵ Finally, for completeness, let us also state that the changes in the informal institutions at the grassroots level are substantial, which are fomented by both macro-level changes (e.g., irrigation management transfer) as well as micro-level changes in conventions and contractual arrangements (e.g., irrigation asset and water sharing conventions).

8.2. Explaining Changes within a Transaction Cost Perspective

As we reflect on the observed changes within the institutional transaction cost framework outlined earlier, we can find some interesting insights into the role and relative significance of various factors motivating these changes in the Indian context. The socio-economic consequences of widespread groundwater depletion, ecological costs of large scale water development projects, storage loss from siltation, and command area loss to water logging and salinity have remained the fundamental factors providing a strong economic motivation for water institutional reforms. Unfortunately, the financial and performance crises of the water sector have failed to gather the political economy thrust needed for prompting concrete actions. From an institutional transaction cost perspective, what this means is the fact that although the opportunity costs of inaction were high in economic terms, the perceived political costs of taking actions were still higher to undermine the reform initiatives.

Fortunately, there were a number of developments—mostly exogenous to water sector—since mid-1970s that have not only reduced the political costs but also magnified the opportunity costs of water institutional reforms. For instance, the earlier practice of making water policy subservient to food self-sufficiency policy

³⁵ The other states where this sort of more is likely to take place in the near future are: Haryana, Rajasthan, and Tamil Nadu (Gulati and Mainzen-Dick, 1996).

has lost its relevance when India eliminated food imports in 1971 and started building a comfortable buffer stock (often going beyond 20 million tons in recent years). Although the first NWP was prompted by a water-related phenomenon of the widespread drought of 1987, it is the political and media fallout associated with this natural event that, in fact, galvanized the necessary political will to declare even such a simple non-binding policy statement. But, the transaction cost calculus with respect to water institutional reform changed rather dramatically with the macro economic crisis of the late 1980s and subsequent declaration of the New Economic Policy of 1991 focusing on financial discipline, economic liberalization, and liquidation of public sector enterprises.

The major impact of the New Economic Policy on water sector has been a radical decline in its budgetary share. For instance, the share of irrigation sector alone has declined from 23 percent of total plan expenditure in the 1950s to 7 percent in recent years. In the wake such budgetary cuts, water-related departments were forced to take a harder look into the ways of cost saving and fund raising from the sector itself. At the same time, farm lobbies that were resisting water rate revision have also realized that farm income is getting increasingly affected by unreliable water supply from poorly maintained irrigation systems. It is these macro economic conditions and their micro economic consequences that have magnified the opportunity costs of reforms from the perspective of both the government and water users. The situation, therefore, has become favorable to revise water rates, involve farmers in cost recovery and system maintenance, and consider broader water sector reforms. It is in this particular environment characterized by economy-wide reforms that the central government constituted the committees for look into issues such as water pricing and private sector participation and the state governments went for the creation of autonomous corporations and the promotion of private sector participation in water sector.³⁶

The revival of interest on many policies that were considered once as anathema or impractical (e.g., irrigation privatization, volumetric water allocation, water rights, and moving water into the concurrent list) indicates the changing balance in the policy debate. This is certainly a positive development and augurs well for the prospects of more substantive reforms in future. From another perspective, the economic and trade liberalization policies initiated since 1991 have also produced significant scale economies in terms of their synergetic effects on water sector reforms. Since water sector reforms form part of an economy-wide reform, the political economy costs of the former became a small proportion of the latter.³⁷ Meanwhile, international lending agencies (e.g., World Bank and Asian Development Bank) and research and technical organizations [e.g., International

³⁶ These changes in the case of Andhra Pradesh, Karnataka, and Maharashtra also have an ulterior motive as they use these unconventional means of financing water projects so as to establish their control over water resources in the Krishna basin before the tribunal award comes for renegotiation.

³⁷ This fact clearly underlines the transaction cost implications and strategic significance of timing and packaging the water sector reform so as to make it coincide with and form part of a larger economy-wide reform program.

Water Management Institute (IWMI) and Food and Agriculture Organization) also have considerable influence on the nature and direction of water sector reforms. For instance, most of the organizational reforms, including the promotion of basin-based organizations observed in states such as Andhra Pradesh, Tamil Nadu, Orissa, and Uttar Pradesh, were introduced under different World Bank-funded projects. Similarly, international best practices and research-based knowledge produced by organizations such as IWMI have also played a catalytic role in reducing the transaction costs of irrigation management transfer programs, especially in Andhra Pradesh and Madhya Pradesh.

While Indian water sector is gradually coming out of the bureaucratic grip and myopic political considerations, it has not yet fully matured to be influenced mainly by economic and technical forces. Unfortunately, the divisive role of political factors is likely to increase, especially on the issue of inter-state water sharing, as most rivers in India are shared by two or more states. As the basin resources are fully appropriated, additional claims will be politically more acrimonious unless institutional arrangements are created to catalyze negotiated settlements and mutual agreements. But, the issue has become complicated by the proposed 'Garland Scheme' for linking rivers, especially when the central government lacks the legal powers and political will to implement the scheme, though has the technical and financial arrangements to complete most of the feasibility studies for various links. It is in this political vacuum and indecisive environment that the Supreme Court of India has been invoked by several public interest litigations to require the government to report on the feasibility and prospects of this Scheme. This legal injunction by the Supreme Court has significantly reduced the political transaction costs for the Scheme. Whatever be the logic and arguments of both the proponents and opponents of the Scheme, the fact still remains that it is one of the long-term options for India to address its future water shortage problems.

9. Concluding Remarks

Despite our selective and eclectic review of Indian water institutional structure and the indirect and tentative way of evaluating its performance, our attempt does leave few interesting observations with considerable implications for both institutional economics theory and water sector reform strategies. The present structure of water institutions in India, as reviewed in terms of some of their major institutional components and aspects shows that it is far from the system that is required for the country to meet its water challenges at present and in future. This observation is reinforced further by a below standard performance of water institutions, as evaluated indirectly in terms of the overall physical, financial, and economic performance of water sector. However, there are notable reform initiatives to strengthen the water institutional structure and improve its performance. These initiatives, undertaken especially since 1991, provide observational evidence for the fact that reform benefits (or, opportunity costs of inaction) are exceeding the

corresponding economic and political transaction costs. But, the fact that institutional changes are uniform neither across institutional components nor across water sub-sectors suggests that both the opportunity and transaction costs vary considerably by institutional and sectoral contexts.

The nature, extent, and coverage of institutional reform clearly provide evidence for the powerful effects that exogenous factors (e.g., economic liberalization policies, political forces, international financial and research institutions, and natural calamities) have on the opportunity and transaction costs of institutional change within water sector. Notably, the initiatives undertaken initially involved only the transaction cost-wise easier and ceremonial options (e.g., declaration of water policy, constituting committees, and marginal legal amendments). However, those undertaken in recent years involved politically difficult and substantive options (e.g., administrative reforms, basin organizations, irrigation management transfer, and reliance on autonomous corporations and the private sector). But, India is yet to move to the stage of embarking on real reforms (e.g., review of centre-state relation in water sector, declaration of an exclusive water law, creation of water rights system at various levels, and administrative reforms for water sub-sectoral coordination, staff resizing, and balanced functional specialization). Understandably, these reform options involve heavy economic and political transactions costs. Although these costs are lower than the potential performance benefits, the differential weights assigned by political leaders often distort the transaction cost calculus.

While India has to go a long way to set right its water institutional structure, from the perspective of a stage-based process of institutional change, the changes observed so far do signify that India is on the threshold of ushering in the substantive phase of institutional reform.³⁸ This observation is based on four reasons. First, although the observed changes are slow, partial, and inadequate, their direction and thrust are on desired lines. Second, the nature and tenor of these changes—both already observed and those proposed in an approved reform blueprint (World bank, 1998)—indicate a clear commitment of the central and state governments to move ahead with the process of institutional change. This commitment is likely to be strengthened further by additional pressures from factors both endogenous and exogenous to the water sector. Third, as the already initiated reforms begin to yield benefits, strengthen pro-reform constituencies, and reduce the technical and political costs of transacting additional reforms, the incentive balance within the institutional transaction cost framework is likely to move toward further reforms. Finally, but, more importantly, since the path dependency properties of institutional change will ensure that it is costlier to return rather than to go ahead in the reform path, further reforms are more likely to be undertaken. As a

³⁸ As per the theory of institutional change proposed by Saleth and Dinar (2003), the change process involves circularity with four distinct stages, each with different dimensions of time and configuration of drivers. These stages are marked by mind change in terms of perceptual convergence among stakeholders as induced by both objective and subjective factors, procedural and ceremonial changes, actual and substantive changes, and the realization of actual performance benefits.

result, the reform process, though can be delayed, can neither be stopped nor reversed.

While the prospects for undertaking higher level reforms are brighter for India, there is an indispensable need for a clear and long-term strategy for reform implementation. In this respect, some of the key insights from cross-country analyses of water institutional reforms (e.g., Saleth and Dinar, 2000 and 2003) can be used both for reform design and implementation. These involve the issues of timing to strategically exploit the synergy effects from exogenous factors, scale-related effects of institutional inter-linkages (e.g., links between WUAs and pricing policy and WUAs and volumetric allocation), and institutional sequencing and packaging (e.g., undertaking easier reforms first and implementing related programs together). As the transaction cost declines and political balance improves as we move on the institutional change continuum, it is prudent to pursue a logically linked sequential reform strategy wherein water sub-sectors and institutional components are prioritized in terms of their performance impact, facilitative roles for downstream reforms, and political acceptability. Since such a strategy can exploit better the synergies from both institutional inter-linkages and exogenous factors with proper timing, packaging, and sequencing of water sector reforms, it has a better chance of success.

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