

INSTITUTIONAL RESPONSE AS AN ADAPTATION TO WATER SCARCITY

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ABSTRACT

Treating different water institutional arrangements as different forms of water governance and using the available literature on the subject, this paper aims to: (a) identify the broad typologies of water governance; (b) apply an analytical framework for characterizing different forms of water governance in terms of their institutional features and operational environments; (c) describe the governance typologies relevant for urban water supply and irrigation water provision; (d) evaluate the relative effectiveness of different governance typologies; (e) discuss the roles of institutional principles and transaction cost theory that govern the process of institutional response and adaptation towards appropriate water governance; (f) conclude with a discussion on the governance configurations appropriate for the conditions of the Americas.

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1. INTRODUCTION

Global water sector has undergone revolutionary changes during the 20th century. Human water use has increased, at least, by six-fold while human population has increased only by three-fold (Cosgrove and Rijsberman, 2000). Added to the demographic growth is also the fact that the world has become more urban than rural since 2007 (United Nations, 2005), causing water pollution and damaging aquatic ecosystems and reducing, thereby, the usable freshwater in many countries. The symptoms of water scarcity are already evident in 80 countries with 40 percent of global population. 18 of these countries, located mostly in the Middle East and North Africa, are actually drawing either close to or over their renewable supply limits (Falkenmark and Lindh, 1993; Gleick, 1993). Already, 55 countries are not in a position to meet even the basic water needs of their growing population. What is notable is the fact that the share of global population facing the predicament of water scarcity and conflict is projected to increase from 44 to 75 percent by 2025 (Postal, 1999: 138-140).

Although water scarcity is usually viewed in physical terms as a widening gap between water demand and supply, in reality, it is much more than a hydrological gap in view of its economic, institutional, ecological, and health consequences. The changing water demand and supply conditions create economic incentives and political compulsions to constantly adapt the institutional arrangements governing water development, allocation, and management. As a result, the physical changes in the water sector have induced concurrent and continuous changes in water institutional arrangements in almost all countries around the world. These institutional changes were not sudden but occurred more as an evolutionary

process and essentially as an adaptive response to the economic, social, political, and ecological costs engendered by increasing water scarcity and water conflicts in different contexts. Unfortunately, the institutional adaptation to water scarcity has been rather slow, uneven, and lagged far behind the real institutional requirements in many countries. Consequently, the institutional arrangements observed in the water sector of most countries remain inappropriate and ineffective in solving their water problems. It is in view of this institutional gap, the prevailing water crisis in most countries is viewed essentially as a 'crisis of governance' [Global Water Partnership (GWP), 2000; Saleth and Dinar, 2004].

The overall objective of this paper is to delineate the existing forms or typologies of water institutional arrangements observed across countries, evaluate them for their relative effectiveness, and identify the institutional arrangements that will be more appropriate for different conditions. Treating different water institutional arrangements as different forms of water governance and using the available literature on the subject, this paper aims to: (a) identify the broad typologies of water governance; (b) apply an analytical framework for characterizing different forms of water governance in terms of their institutional features and operational environments; (c) describe the governance typologies relevant for urban water supply and irrigation water provision; (d) evaluate the relative effectiveness of different governance typologies; (e) discuss the roles of institutional principles and transaction cost theory that govern the process of institutional response and adaptation towards appropriate water governance; (f) conclude with a discussion on the governance configurations appropriate for the conditions of the Americas. The paper is organized in line with the listed set of objectives. As to its approach and scope, the paper relies on analytical approaches and

anecdotal evidences from a few countries and focuses mainly on the irrigation and urban water sub-sectors, which together share most of the water used in many countries.

2. TYPOLOGIES OF WATER INSTITUTIONAL ARRANGEMENTS

From an analytical perspective, water institutions are defined as the configurations of various legal, policy, and organizational elements involved in water development, allocation, ownership, use, and management (Bromley, 1989; Ostrom, 1990; Saleth and Dinar 2004). Such institutional configurations or water institutional arrangements differ considerably in terms of their sectoral coverage, resource focus, and unit of analysis. For instance, the institutional arrangements governing the irrigation sectors are different from those governing urban water supply. Likewise, the institutional arrangements related to water quantity are different from those related to water quality. Similar distinctions also exist between the institutional arrangements governing groundwater and those dealing with surface water. Water institutional arrangements also differ in terms of their scale of coverage and unit of analysis such as watershed, aquifer, river basin, region, country, and trans-boundary (Ostrom, 1990; Huitema and Bressers, 2007; Tropp, 2007). Despite their contextual variations, water institutional arrangements do have strong lateral and hierarchical linkages across contexts due to inter-sectoral, inter-source, and inter-regional water dependence.

Much more important than the contextual variations in water institutional arrangements are their typologies in terms of the underlying ownership pattern, functional form, and decision structure. These institutional typologies are useful to distinguish institutional arrangements found in different contexts and also to evaluate them for their relative effectiveness and performance. For instance, in terms of the property rights or ownership, water institutional arrangements can be characterized as open access, common

property, state property, and private property (Ostrom, 1990; Bromley, 1992). Similarly, from a functional perspective of water provision and water allocation, water institutional arrangements are also characterized as state or bureaucratic, community-based and user-oriented, and markets-centric (Meinzen-Dick and Mendoza, 1996; Dinar, et al., 1997). One can also add here another institutional typology based on private water companies operating both in urban and irrigation sectors. Water institutional arrangements are also distinguished as centralized vs. decentralized, public vs. private, single actor vs. multiple actors and stakeholders, top-down vs. bottom-up, and bureaucratic vs. market-centric. In terms of decision structure, water institutional arrangements are also characterized as hierarchical, poly-centric, and distributed (Kooiman, 1993; Keohane and Ostrom, 1995; Ostrom, et al., 1999). Based on these considerations, one can identify six distinct institutional typologies, i.e., open access, state, community, user, private, and market-centric arrangements.

The ownership, function, and decision system-based typologies of water institutional arrangements noted above are overly simplistic. This is because they subsume the wide variations both in the structural features and operational environment of the institutional typologies. These variations are important because they have a major bearing on the relative performance of different institutional typologies. For instance, the open access system under water abundant conditions will have differential performance as compared to the same under water scarce conditions. Likewise, the state-based arrangements found in developed countries differ from the same found in developing countries due to differences not only in information, technology, and enforcement but also in the scale of operation, resource conditions, political factors, and general intuitions. Similarly, the private provision of urban water supply subsumes varying arrangements such as service or management contract, lease,

concession, and complete transfer. The fact of diversity and the role of exogenous factors are also equally applicable to both user and market-based institutional arrangements. Market-based arrangements vary both within and across countries in terms of the nature of property rights (riparian rights, appropriative rights, water permits, or water quotas) and the conditions for their issue and use. Similarly, in terms of their organizational features and rule structures, the user and community-based arrangements also vary both within and across countries.

3. WATER GOVERNANCE FORMS: STRUCTURE AND ENVIRONMENT

The diversity in the features of institutional typologies and the role of non-institutional and external factors in institutional performance suggest two key points: (a) the six institutional typologies noted above represent only the discrete points within the long continuum ranging between complete open access system to a full fledged market-centric arrangement; and (b) for evaluating the effectiveness and performance of different institutional typologies, it is necessary to look both at their structural features and also at their external environment as characterized by demographic, resource, economic, social, institutional, and political factors. In order to demonstrate the internal institutional features and external influence of both institutional and non-institutional factors, it is instructive to view different water institutional typologies as different forms of water governance. For this purpose, the analytical framework developed by Saleth and Dinar (2004) is useful. Before the application of the analytical framework, let us first define water governance and show its relation with water institutional arrangements.

The concept of water governance has different but closely related definitions (see GWP, 2000; Rogers and Hall, 2003; Franks, 2004; Tropp, 2007). The GWP (2000), for instance, defines water governance as the range of political, social, economic, and

administrative systems that are in place to develop, allocate, and manage water resources at different levels. According to Roger and Hall (2003), water governance “encompasses laws, regulations, and institutions but it also relates to government policies and actions, to domestic activities, and to networks of influence, including international market forces, the private sector, and civil society. These, in turn, are affected by the political systems within which they function”. From an institutional economics perspective, this definition distinguishes clearly the two analytical dimensions of governance, i.e., ‘governance framework or environment’ and ‘governance structure’ (North, 1990; Saleth and Dinar, 2004). These two analytical dimensions are presented in figures 1 and 2 respectively.

Figure 1 depicts the water governance environment within a simplified setting. The governance environment covers the elements of the general governance system in the country, including the constitution and political arrangements, and the roles of technology, resource potential, development stage, and demographic conditions. Figure 1 shows clearly how the water governance structure is embedded within the water governance environment. The water governance structure operates within the governance environment defined not only by the exogenous factors but also by the general governance system of the sector, region, or the country itself. Thus, the institution-performance interaction within the water sector is influenced not only by factors that are both exogenous and endogenous to the water sector but also by the water governance structure itself. A change in any of these factors can, therefore, affect the performance of water institutional arrangements, irrespective of their typologies. The importance of the role of the institutional and non-institutional elements defining the governance environment also suggests that water scarcity is only one among many factors that determine institutional change, adaptation, and performance.

While the water governance environment captures the influence of external factors, water governance structure captures the effects of internal institutional features. As a result, the water governance structure constitutes the institutional setting within which water sector operates. It covers essentially the water-related legal, policy, and organizational elements.

To
see

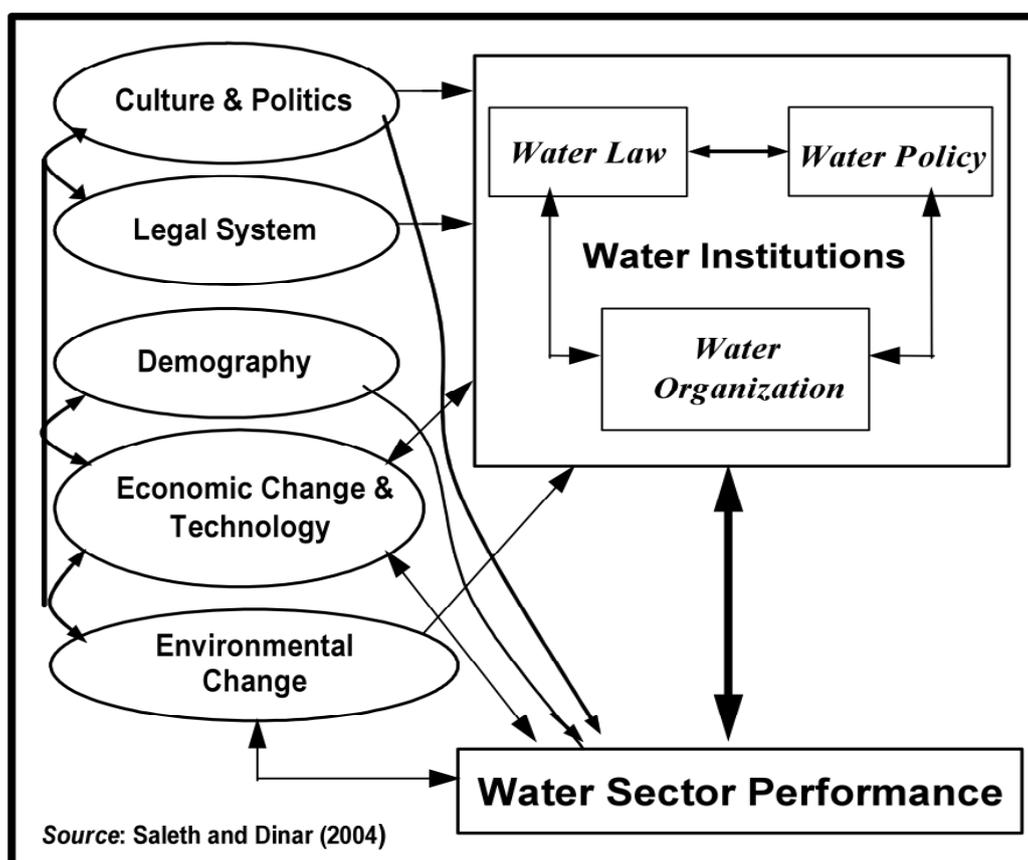


FIGURE 1

WATER GOVERNANCE ENVIRONMENT

these elements, one can follow an unbundling exercise. Initially, water governance structure is unbundled to identify its three main components, i.e., water law, water policy, and water organization. Then, each of these components is unbundled further to identify the key institutional aspects as shown in Figure 2. The main analytical advantage of this exercise is that it is possible to trace the structural and functional linkages evident both within and across

the institutional components. These institutional linkages are very important determinants of performance in the sense that the stronger are these linkages within and among institutional

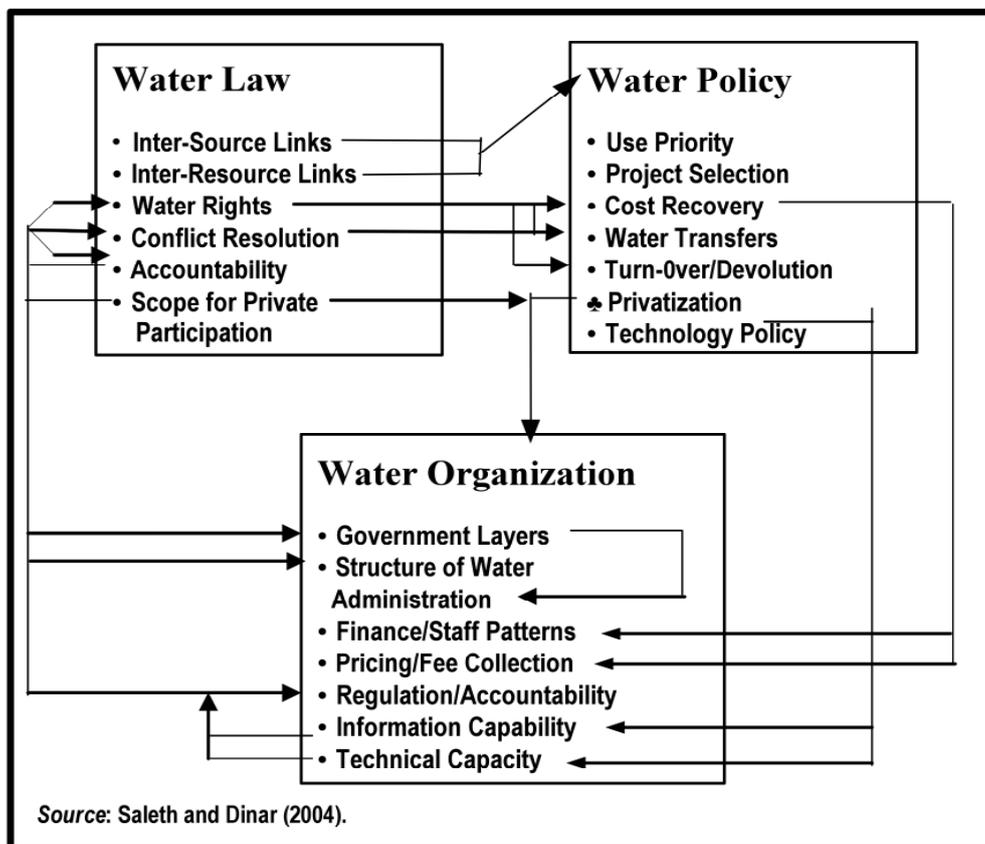


FIGURE 2
WATER GOVERNANCE STRUCTURE

components the more effective will be the water governance structure.

The analytical framework depicted in figures 1 and 2 deals with water governance at the macro or national level. Similar framework can also be specialized for specific contexts such as water sub-sector, water source, and spatial scale. The water governance arrangements in these specific contexts, though will have unique characteristics, are not independent but hierarchically or laterally linked for the obvious reason of inter-sectoral, inter-source, and inter-regional water dependence. In view of this fact, different governance typologies, though distinct, operate more in a complementary than in a competitive manner. In this sense, the institutional typologies, though can be alternative in specific contexts, are compatible with each other in the larger context of water governance.

As we apply the analytical framework specified in figures 1 and 2, we can identify a wide variety of governance forms even within the same institutional typology, depending on the nature and feature of the underlying institutional elements shown in Figure 2. In this sense, the range of governance forms will include not only the six discrete institutional typologies (i.e., open access, state, community, user, private, and market-centric) but also all

the institutional variants that are intermediate to all the six typologies. Since the institutional configurations in each of these governance forms are different, they will have differential performance even within the same governance environment. Similarly, the same governance form can have a differential performance when there are changes in the configuration of exogenous factors defining the governance environment as shown in Figure 1.

4. EXISTING WATER GOVERNANCE TYPOLOGIES

Although we can identify a wide variety of governance forms, each varying in their institutional details and operational environments, for analytical convenience and simplicity, we will use only the six governance forms noted above. Since they are easier to identify in specific context, we will evaluate the existing governance typologies by water sub-sectors.

4.1. Governance Typologies in Urban Water Sector

Broadly speaking, seven governance forms are observed in urban water sector. These governance forms and their relationship with each other are depicted in Figure 3 and the institutional features of some of these forms are presented in Table 1. As can be seen, these governance forms are distinct in terms of the asset ownership, decision making, risk allocation, and economic incentives (Menard, 2009). The seven governance typologies or forms can be grouped into three governance categories, i.e., state provision, private sector participation, and private provision. State provision includes both the state-based governance arrangements involving agencies such as public bureaus, municipalities, and other local government bodies as well as the governance arrangement involving autonomous public corporations run on commercial principles.

Although converting public water utility into corporatization provides autonomy and incentives to operate on commercial lines, such an attempt avoids neither the public

ownership of assets nor the political interferences, which are rampant in developing countries (Menard and Saleth, 2010). Between the two extremes of state and private provision lie the

TABLE 1: INSTITUTIONAL FEATURES OF SOME URBAN WATER GOVERNANCE FORMS.

Particulars	Public Corporation	Management contract	Lease contract	Privatization
Property Rights	Public	Public	Infrastructure: Public Equipment: Private	Private
Autonomy of decision rights	Partial (Political control in last resort)	Limited. Strategic decisions remain in public hands	Extended, but also dependent on decisions of public authorities	In theory: total. In Practice: highly regulated
Risk sharing	None: public	None: public	Very limited for lessee	Total (but can be limited by contractual clauses)
Incentives	Weak	Weak (cost plus system)	Intermediate	Strong
Mode of Regulation	Command-and-control	Combination of public bureau and contract	Through contracts	Regulatory agency or competition laws
Political interferences	Significant	Significant	Mostly on strategic decisions (through control over major investments)	In principle: none In practice: through regulator

Source: Menard and Saleth (2010)

four forms of public and private partnership in water service delivery. The category of public-private partnership involves different combinations of public and private sector roles in the provision, management, and regulation of urban water supply. This category includes the four governance forms involving management contract, service contract, lease, and concession. In this governance category, as move from the left to the right, the role of private sector is increasing in the operation of the water supply system while that of the public sector is declining to confine mostly to regulatory or facilitative functions.

While the service contract allows private participation in the delivery of specific services (e.g., fee collection and system maintenance), the management contract allows the

private sector to operate the water supply system for a management fee. Under the lease contract, the private operator gets the full responsibility for management and maintenance and gets the profit while the government has the responsibility for the asset and investment. In the arrangement involving concessions, the state transfers the entire responsibility to the private operator usually under certain conditions stipulated by the public authorities related especially to the expected level of investment and permitted range of water rates. The concession has variety of forms such as Build-Operate-Own, Build-Operate-Transfer, Build-Own-Operate-Transfer, etc. Under full privatization, the private operator has a complete control and full responsibility for the development, operation, and management of the system.

Besides the seven forms of urban water governance noted in Figure 1, one can also add two other forms, which are becoming important due to the limitations of both the public and private arrangements in delivering urban water services. One is the arrangement involving the role of local entrepreneurs and small independent water providers. They are common in Latin America, Africa, and Asia. Their importance can be judged by the fact that they serve about 25 percent of the urban population in Latin America and 50 percent of the same in Africa (Davilla and Whiteford, 2009). The other form involves the role of urban water cooperatives such as those operating in the Municipality of Morenos, Buenos Aires, Argentina (Moccia, 2007).

Corporatization of public water utilities is observed particularly in Latin America and Australia. Public-private partnership has been tried in a number of countries in the 1990s, essentially through management or lease contracts (Gassner, et al., 2009). Full privatization has been tried with varying degrees of success in Australia, UK, USA, and Chile. Based on a review of 977 urban water utilities in 71 developing countries during 1973-05, Gassner, et al.

(2009) concluded that while 85 percent of these utilities were state or state-owned enterprises, only the remaining 15 percent were under different forms of public-private partnership. Notably, over 67 percent of the utilities under public-private partnership were concentrated in the Latin American and Caribbean regions. The market share of the utilities under the public-private partnership in the developing and emerging countries has increased from about one percent in 1997 to seven percent in 2007. During 1990-2002, the number of people being covered by some sort of privatization has increased from 51 to 300 million (Palaniappan, 2004). The number of utilities under public-private partnership has reached the peak at the end of the 1990s, followed by an abrupt decline, except for a brief upward trend during 2003-05, followed, again, by a declining trend (Marin, 2009: 24).

4.2. Water Governance Forms in Irrigation Sector

All the six governance typologies that we have identified, i.e., open access, state, community, user, market, and private, are relevant for irrigation sector. While considering these forms of governance across countries and regions, it is useful to keep in mind the following two key points related to their spatial and structural relationships. First, since the irrigation sector is spatially vast and physically diverse across countries and regions, all these forms of governance can co-exist to fit different agronomic, socio-economic, and regional needs. Second, although some governance forms can be alternative (e.g., state or private and bureaucratic or market-based) in specific contexts, from a general perspective, they can be complementary in the sense that even within a centralized and bureaucratic system, community, user, and market-based water allocation can operate without much difficulty.

There is a rich body of knowledge on the nature and features of water governance arrangements in the irrigation sector in a wide variety of countries around the world (Maass

and Anderson, 1978; Ostrom, 1990; Keohane and Ostrom, 1995; Ostrom, et al., 1999; Saleth and Dinar, 2000 and 2004). Broadly speaking, state or bureaucratic allocation and management of surface water is common in most of the countries in Asia and Africa, including India and China. Regarding groundwater irrigation, most countries lack any formal or systematic governance arrangements, leading to anarchy in groundwater withdrawal and use. Although a formal and legally specified water rights system is absent, under a *de facto* system of rights operating within an open access regime, groundwater markets have emerged in several countries such as India, Pakistan, China, Bangladesh, Indonesia, and Jordan (Shah, 1993; Saleth, 1994; Mainzen-Dick and Mendoza, 1996; Dinar, et al., 1997). Reviews of groundwater markets in India, for instance, suggest that they are quite effective in promoting efficiency in water use and equity in the access to water by small farmers, but lead also to aquifer depletion and inter-generational inequity (Saleth, 1994; Palanisami, 2009).

Market-oriented governance forms are common in the allocation of irrigation water in the western states of the US (especially, California, Colorado, and New Mexico) and countries such as Australia, Chile, Mexico, and Spain (Colby and Bush, 1987; Rosegrant and Schleyer, 1994; Rosegrant and Binswanger, 1994; Dinar, et al., 1997; Garrido, 1997). They are supported by a formally specified and volumetrically defined water rights system for both surface water and groundwater and by an efficient water measuring and conveying infrastructure. Notably, in these cases, the state plays major roles in the spheres of regulation, enforcement, and monitoring of water rights. The state also plays a facilitative role by providing information and sharing conveyance facilities for water exchanges. The community-based forms of water governance exist in countries such as India, Nepal, and

Bangladesh as well as in many countries in Africa. They confine mainly to surface water, especially in the context of small streams and other water bodies in fragile regions.

Although the state-centered arrangement is the dominant form of irrigation governance in the surface water regions of most developing countries, there have been significant changes thanks to the increasing role of user organizations in water allocation and management, especially at the outlet level. With the implementation of the irrigation management transfer program since the 1970s, many water user associations were created in countries such as Mexico, Columbia, Turkey, Philippines, Indonesia, India, Pakistan, and Bangladesh (Vermillion, 1997). These user-based governance forms, which are operating within the overall state-based governance, deal with such functions as fee collection, system maintenance, water allocation, and conflict resolution at the outlet level. In contrast to mere water management transfer, the entire irrigation systems, including their ownership, operation, and management, were also transferred to user groups or irrigation companies in Argentina, New Zealand, and Australia.

As to the private form of irrigation governance, there are numerous examples such as the irrigation and ditch companies and irrigation mutual companies operating in the South-Western US and in the Murray, Coleambally, and Murrumbidgee Irrigation areas located in the New South Wales and Victoria states in Australia (Colby and Bush, 1987; Lynne and Saarinen, 1993; Meinzen-Dick and Mendoza, 1996; Saleth and Dinar, 2004). A new form of governance arrangement has also emerged in India, which involves the formation of irrigation water development corporations such as the Krishna Water Corporation created by Karnataka in 1994 and the Krishna Valley Development Corporation floated by Maharashtra in 1996. As these corporations obtained their funds through redeemable long-term 'water

bonds' assuring a rate of return up to 17 percent, they have incentives for achieving financial viability, accountability, and efficiency (Saleth, 2004).

5. RELATIVE EFFECTIVENESS OF GOVERNANCE TYPOLOGIES

How do we evaluate the relative effectiveness and performance of different governance typologies? This evaluation can be done using both a rigorous approach involving statistical analysis as well as simple approach involving descriptive analysis. Both approaches rely on a combination of qualitative (subjective) and quantitative (objective) information on some of the key institutional and performance features of water governance. However, the rigorous approach uses one or more variables to capture the micro and structural features of water governance whereas the descriptive approach uses a set of indicators to capture the macro and functional features of water governance. The effectiveness of each institutional aspect of water governance (i.e., the legal, policy, and organizational elements specified in Figure 2) can be evaluated more closely using one or more variables to capture its status and effectiveness. The overall effectiveness and performance of water governance can be evaluated based on the results for individual institutional elements. This rigorous and variable-based approach is particularly effective for the evaluation water governance arrangements in comparative and cross-country contexts (see Saleth and Dinar, 2004).

Although the rigorous approach is more realistic, it is information-wise much demanding, requiring special surveys to capture the institutional assessment by stakeholders. It is also less appealing for evaluating the relative effectiveness of governance forms within a given regional or sub-sector contexts, where they are complementary rather than alternatives. In this context, the descriptive approach based on indicators capturing the overall macro and functional features of water governance are easier to develop and apply. As a result, we rely

here on the indicators suggested by Rogers and Hall (2003) for the evaluation of the relative effectiveness of different governance typologies. These indicators are: (a) transparency, (b) accountability, (c) participatory, (d) communicative, (e) integrative, (f) efficiency, (g) incentive-compatibility, (h) sustainability, and (i) equity. We can also add the criteria of feasibility and replicability given the physical, socio-economic, political, and technical conditions present across countries (Menard and Saleth, 2010). Although some of these indicators can be assessed quantitatively in a specific context (e.g., efficiency and equity), others can be evaluated largely from a qualitative perspective and descriptive context.

As we apply these indicators for evaluating the governance typologies observed in urban water sector, we find that the governance form involving state bodies fails on most counts. Although the governance form involving the publicly-owned but autonomous corporation is conducive for efficiency, transparency, and accountability, it has a fundamental incentive problem, especially when there is excessive political interference. As to the relative performance of governance forms involving private sector participation, the evidences are mixed (Marin, 2009; Davilla and Whiteford, 2009). Based on the results of their empirical study, Gassner, et al. (2009: 4-5) conclude that there has been some gains in staff productivity and mixed gains in efficiency but no gains in investment levels and no significant changes in price levels. Similarly, based on a review of 27 econometric studies covering hundreds of water utilities, Perard (2009) concludes that only eight of these studies have shown private operators to be more efficient than public operators. Three studies have shown the public entities to be more efficient. But, the remaining 16 studies found that there was no substantial difference in efficiency. The governance form involving independent water

providers, who serve mostly the excluded groups and poorly served peri-urban areas, promotes equity and accountability.

Turning to the irrigation sector, a state-based centralized system is more efficient and equitable than the open access regime because the former reduces the anarchy in resource use and enhances the access by poor groups. But, when compared to decentralized arrangements such as the user-based or market-oriented system, a centralized system cannot be considered effective because it fails to meet the desirable features of efficiency, accountability, transparency, and participation (Rosegrant and Binswanger, 1994; Meinzen-Dick and Mendoza, 1996; Dinar, et al., 1997). More importantly, the state-based governance arrangements, especially in developing countries, also lead to rent-seeking and corruption (Wade, 1982; Repetto, 1986). The market-based system, although efficient, transparent, and participatory, may not be able to meet the equity and sustainability criteria (Brown and Ingram, 1987; Dinar, et al., 1997). Similarly, decentralized arrangements, including market, user, and community-based arrangements, are effective in terms of transparency, participation, and equity (Dinar, et al. 1997; Vermillion, 1997). But, for achieving the goals of the integrated water resource management, decentralized systems may not be effective, unless they are functioning within an overall framework of centralized coordination. Community-based governance arrangements, though promote equity, participation, and sustainability, they are difficult to upscale or replicate in view of their context-specificity.

6. INSTITUTIONAL RESPONSE, ADAPTATION, AND APPROPRIATE GOVERNANCE

The appropriateness of a governance typology or a configuration of governance typologies depends on the application context, water-related functions, supportive conditions (technology, infrastructure, and information), and sector, region, and country-specific

requirements. For instance, the governance typology involving water markets is difficult to introduce in contexts where there are no formal water rights system and suitable water infrastructure. Similarly, market and user-based arrangements can be efficient in performing the allocation function, but state-based institutional arrangements are necessary to perform the regulatory and enforcement functions. This means that the identification of the appropriate governance form(s) requires a demarcation of different water-related activities such as planning, allocation, use, management, and regulation. While governance forms with centralized features are required for planning and regulation as well as for protecting poor groups and environment, market or user-based mechanisms are ideal for water allocation.

The governance form(s) appropriate for a given context emerge as an adaptive response to the changing physical, economic, and institutional requirements of the water sector. Such an institutional adaptation takes the form of either an autonomous institutional evolution or induced institutional changes through purposive reforms. These adaptive processes of institutional evolution and change are governed by two major factors. One relates to the role of a few institutional principles and the other relates to the role of the institutional transaction cost theory. Institutional principles such as path dependency and structural and spatial embeddedness play a major role in the evolution and development of an appropriate governance arrangement (Ostrom, 1990; Saleth and Dinar, 2004). They limit the governance options that are feasible for a given context. For instance, in the case of most developing countries in Asia and Africa, the introduction of a full-fledged water markets is difficult because of the constraint imposed by the absence of both the formal water rights and the technical and organizational conditions necessary to underpin water market operation. In

this case, water markets are path dependent and structurally embedded with the water rights system as well as with the enforcement and monitoring mechanisms.

Another institutional principle affecting institutional adaptation and governance choice relates to the nature of the process of institutional change itself. Institutions change only slowly and gradually over a long evolutionary process (North, 1990). In this sense, the development of an appropriate institutional typology or configuration is not a single step activity but involves constant and consistent process of institutional reforms undertaken over a period of five to ten years, depending on resource availability, existing institutional potential, and political economy context (Saleth and Dinar, 2006). While the path dependency ensures that change once happened cannot be reverted back, the 'scale economies' in institutional change, and 'increasing returns' in institutional performance ensure that institutional change becomes self-sustaining once a critical minimum level of change has been initiated (North, 1990: 95&100). This means that the evolution and development of an appropriate governance arrangement is closely linked with the process of institutional reform and change.

The nature and intensity of water institutional reforms, which are needed for creating an appropriate governance typology or configuration, depend on the real and monetary costs of transacting the institutional reforms. These costs, known as the 'institutional transaction costs', cover not only the economic and financial costs but also the social and political costs of undertaking the reforms. The institutional transaction cost theory basically compares these transaction costs of creating a given governance typology with the opportunity costs or social losses associated with an inappropriate governance typology or configuration. When the opportunity costs are more than the transaction costs, there is an economic justification for

institutional change and adaptation. Otherwise, the prevalent governance typology is optimal from the perspective of the institutional transaction cost theory. For instance, in the case of many developing countries with vast and diverse irrigation sector with millions of small farmers, the transaction costs (including the social and political risks) of developing a water rights system and market-based governance typology may very well outweigh their opportunity costs, especially in the reckoning of political leaders.

Fortunately, the transaction and opportunity costs are not static but change due to the influence of various factors implicit in figures 1 and 2. The factors that affect the opportunity costs are mostly endogenous to the water sector such as water scarcity, use inefficiency, water conflicts, financial crisis, drought/floods, and water quality problems. But, the transaction costs is influenced not only by the exogenous factors such as political reforms, macro economic crises, social issues, water agreements, and donor pressures but also by the internal institutional factors related to water governance structure itself. For instance, the political and economic reforms can reduce the transaction costs of water institutional reforms because the later form only a small part of the former. Similarly, the transaction costs are also reduced by institutional factors such as path dependency, scale economies, and institutional synergy (Saleth and Dinar, 2004). For instance, the prior existence of institutional elements such as water rights and user organizations makes it easy for water markets to emerge. This means that the costs of undertaking subsequent institutional reforms tend to decline as the reform reaches higher and higher stages (Saleth and Dinar, 2006).

Due to their influence on either the opportunity or transaction costs, the endogenous and exogenous factors play a major role in triggering water institutional reforms and paving, thereby, the way for the process of institutional change and adaptation. The relative

importance of these factors in the recent reform initiatives observed in six countries is shown in Table 2. Although water scarcity and conflicts remain the underlying force for reforms in all cases, there is variation in the immediate factor(s) that trigger the reforms across the countries. For instance, in Australia, the reform trigger came from salinity, drought, and macro economic reforms. In Mexico and Sri Lanka, the macro economic crisis of the 1980s was the dominant trigger for water institutional reforms. In Chile and South Africa, dramatic political change provided the necessary trigger for water institutional reforms. In Morocco, physical scarcity of water due to a near-exhaustion of freshwater was the main trigger. The water institutional reforms in Namibia were part of the economic and political reorganization of the country following its independence in 1990.

TABLE 2: RELATIVE ROLE OF FACTORS BEHIND WATER GOVERNANCE REFORMS

Particulars	Australia	Chile	Morocco	Namibia	South Africa	Sri Lanka
Water scarcity/conflicts	**	*	**	**	**	*
Financial crisis	*	**	**	***	*	***
Draughts/salinity	***	-	***	*	**	-
Macro economic reforms	***	**	***	-	-	***
Political reforms	-	***	-	***	***	*
Social issues	*	-	*	**	**	-
Donor pressures	-	*	**	*	-	***
Internal/External agreements	***	-	-	*	*	-
Institutional synergy/pressures	**	***	*	*	*	*

Note: The number of *s signifies the relative importance of the factors in the context of each country. '- ' means that the aspect in question is 'not applicable' or 'not evaluated'.

Source: Saleth and Dinar (2005)

Despite the political difficulties, institutional change and adaptation have occurred in many countries both due to the natural process of institutional evolution as well as due to the

purposive reforms undertaken by the state. The institutional change and reform process have improved the appropriateness of their water governance arrangements in many contexts. Specific reforms observed across countries include the creation of basin organizations, promotion of user organizations, and decentralization to promote stakeholder participation, privatization of urban and irrigation water supplies, establishment of water rights system, promotion of inter and intra-sectoral water markets, reorientation of water prices, and implementation of water quality regulations (Saleth and Dinar, 2000 and 2006).

The general thrust of institutional change and adaptation is indeed positive from a long-term historical perspective. But, they are far from adequate for creating the governance arrangements that are required for meeting the current and future realities of the water sector in many countries. From an overall perspective, some countries (e.g., Australia and Chile as well as regions like California and Colorado in the US) already have a relatively more effective water governance configuration. Others (e.g., Spain, Mexico, Chile, South Africa, Brazil, and China) are moving quickly to develop the institutional potential needed for effective governance whereas the remaining countries (e.g., India, Pakistan, Sri Lanka, Indonesia) have a long way to go in creating more appropriate water governance arrangements (Saleth and Dinar, 2004).

7. CONCLUDING REMARKS AND POLICY IMPLICATIONS

There is no particular governance typology that is appropriate to all contexts. Some governance typologies are relatively more effective than their counterparts in specific contexts and in achieving specific goals. Some are good for efficiency while others are good for equity. Similarly, for some functions such as planning and regulation, centralized forms may be better on scale-economic and technical considerations. But, for other functions such

as allocation or day-to-day management, decentralized and market or negotiation-based arrangements are better in terms of their flexibility. From a general perspective, however, the different governance forms remain complementary to each other as they often operate side-by-side or hierarchically. As a result, cooperative relationships among various governance forms, representing complementary logics and functions, will provide a more durable solution (Blatter and Ingram, 2000). In this sense, rather than being dogmatic, it is more realistic to look for a more appropriate mix or configuration of governance forms that can fit well with the varying economic, resource, and institutional conditions prevailing across sources, sectors, regions, or countries.

As to the appropriate governance forms for the Americas, the answer depends on how different are the water challenges facing the countries in this region as compared to other countries in the rest of the world. In many respects, the countries in the Americas face, more or less, the same set of water problems as found elsewhere in the world. However, there are also a few but very important distinctions.

First, the American continent, taken as a whole, is blessed with a relatively abundant water supply condition. But, there are vast regional variations in water supply. For instance, the regions such as the western parts of the US, the north-eastern region in Brazil, northern Mexico, coastal region in Peru, and southern parts of Chile face severe water scarcity as water demand far exceeds the available supply.

Second, the demographic pressure on water resources is relatively lower as compared to other continents. But, the population concentration due to urbanization is more intense in the Americas, especially in South America, as urban areas account for more than 75 percent

of the total population. As a result, with the exception few regions, the water sector is oriented more towards the urban, industrial, and mining sectors than the irrigation sector.

Third, with the exception of Australia and few countries in Europe, most countries in the American continent have a relatively more matured water institutional arrangement with a relatively advanced water law and policy framework and water management organizations.

Fourth, similarly, they also display a relatively stronger orientation towards the private sector (in urban water supply) and market-based allocation (in irrigation sector). But, the state also plays a more constructive role both in water planning and regulation as well as in facilitation of more decentralized institutional arrangements such as irrigation districts, river basin organizations, and institutional framework for stakeholder participation.

Fifth, unlike countries such as India and China, groundwater use in the Americas is not that widespread but confined only to a few regions such as the Ogallala aquifer in the US.

Finally, unlike many countries in Asia, Middle East, and North Africa, where water quantity is the dominant problem, the countries in the Americas have an equal focus on both water quantity and water quality.

Despite these distinguishing features of the water sector in the Americas, the main characteristics of the institutional arrangements appropriate for this region remain, more or less, the same as those appropriate for most countries in the world. Considering the diversity of economic and resource conditions present in the Americas, no single governance form can be advocated as 'the solution'. Multiple and poly-centric governance forms are needed to meet different regional and sectoral requirements. Indeed, such a governance configuration has actually evolved in this region over time. For instance, in most of the water scarce but agriculturally advanced regions, market and user-based governance forms have already

emerged. Notably, these governance forms are operating within the general framework of state-based regulatory and enforcement arrangements. In California, for instance, 80 percent of inter-regional water transfers within the state were facilitated by the state-managed water conveyance networks. The state has not only promoted water banks to manage inter-year variations in water supply but also entered into the water market as a key player for buying water for meeting environmental needs.

Water markets have also emerged in countries such as Canada, Chile, Brazil, and Mexico. Basin organizations, watershed committees, and irrigation districts have also been developed to institutionalize stakeholder participation in water allocation and management decisions. In Countries such as Mexico and Columbia, irrigation management has been transferred to user associations. In urban water supply, Latin America and the Caribbean regions account for 67 percent of the total public-private partnership arrangements observed at the global level. Corporatization of urban water supply entities and provision of autonomy to municipal and local water supply units have enhanced the user coverage, service quality, and financial performance. Despite the general tendency towards market, private, and user-based governance forms, in the areas of water resource planning and development as well as environmental and water quality protection, the state and the state-based organizations continue to play a dominant role. Thus, the actual situation in the water sector of the countries in the Americas can be characterized as a multiple and poly-centric water governance system. But, just as the present governance configuration is the outcome historical evolution, the future configuration will also evolve as an adaptive response to water scarcity and other economic and institutional requirements. However, judging by the trend observed so far, the optimal governance configuration for the countries in the Americas will

become more and more oriented towards market, user, and private-oriented governance forms as compared to their counterparts in the rest of the world.

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