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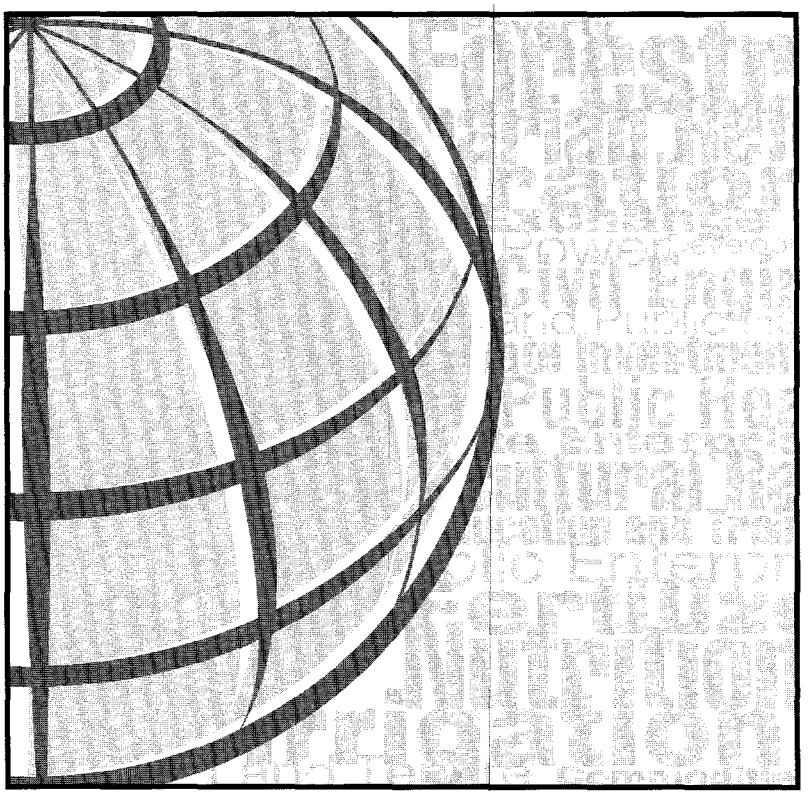

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Ariel Dinar

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Evaluating Water Institutions and Water Sector Performance

R. Maria Saleth
Ariel Dinar

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R. Maria Saleth is a reader, Institute of Economic Growth, Delhi, India. Ariel Dinar is a principal economist in the World Bank's Rural Development Department.

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FOREWORD

The water sector is undergoing remarkable changes in recent years. While past achievements were associated mainly with investment in new physical structures, recent developments in the water sector is associated to a greater extent with improved management and institutional changes. Although both the nature and direction of these institutional changes vary by country-specific economic, political/cultural, and resource realities, there are clearly identifiable trends and patterns.

The 1993 World Bank Water Resources Management Policy calls for a comprehensive water resources framework that recognizes appropriate management of water resources, that rely also on sound institutions. World Bank portfolio includes now water projects with massive components of institutional reforms, at all water sub-sectors and management levels. As such, World Bank's projects are part of the trend of change identified at international level.

Evaluation of the institutional changes that occur and the consequential performance of the water sector are not straightforward. While country-specific studies describing institutional changes in the water sector are common, comparative studies evaluating the institutional underpinnings of water sector performance with a cross-country perspective are rather rare. Cross-country studies can help not only in understanding the major water sector challenges but also in delineating the contour of ongoing institutional responses, under various country-specific conditions.

This report suggests a new methodology to shed light on the process of institution-performance interaction. The report demonstrates the use of the methodology by applying it to an extensive cross-country data set, and by deriving policy guidance based on the results. We hope that this report will stimulate thought and debate about methodologies and strategies to be used in order to evaluate institutional change and institution-performance interactions in the water sector.

Alexander F. McCalla
Director
Rural Development Department

ABSTRACT

This study develops an analytical framework to identify various layers of institutional inter-linkages and institution-performance linkages evident in the process of institution-performance interaction within water sector. The study then evaluates the layers of linkages using an evaluation methodology that uses perception-based cross-country data. Both these analytical and empirical analyses are then used to identify key inputs for developing a generic strategy for water institutional reform. Results provide several major insights: They indicate the relative strength, direction, and significance of the performance impact of institutional components and institutional aspects; they suggest clearly that the institution-performance interaction can derive from the general socio-economic, political, and resource-related environment within which such an interaction occurs; and they strongly favor a sequential strategy for institutional reform in general and for water institution in particular.

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EXECUTIVE SUMMARY

The major thrust of institutional reforms within water sector is to enhance the functional capabilities, operational strength, and institutional readiness to handle water challenges both at present and in future. Given this thrust, the main objectives of institutional initiatives are rather transparent. These objectives are to: address water as an economic good, strengthen allocation capabilities, increase the reliance on market forces, revive the payment culture, ensure financial self-sufficiency, promote decentralized decision structure, and encourage the adoption of modern technology and information inputs. While the economic and resource-related rationale for both the thrust and objectives of institutional change are well known, there is a lamentable dearth of understanding on the issue of how to affect water institutional change within the political economy constraints as well as opportunities.

In an attempt to bridge this knowledge gap, this study develops an analytical framework to identify various layers of institutional inter-linkages and institution-performance linkages evident in the process of institution-performance interaction within water sector and evaluates these layers of linkages using an innovative evaluation methodology based on perception-based cross-country data. Both these analytical and empirical analyses are then used to identify key inputs for developing a generic strategy for water institutional reform. Such strategy can minimize the transaction cost but maximize the performance impact. This study has some unique analytical and methodological contributions to make in the context of institutional economics in general and water institution in particular. These are as follows:

First, this study, for the first time, makes an analytical decomposition of both the water institution and water sector performance. Briefly, water institution is decomposed into three broad components, i.e., water law, water policy, and water administration. Each of these institutional components is again decomposed to identify some of its major institutional aspects. Similarly, water sector performance--considered to cover the performance of all water sub-sectors--is also decomposed in terms of its physical, financial, economic, and equity dimensions. Utilizing this decomposition exercise, the institution-performance interaction within the water sector is elaborated to analytically demonstrate some of the major layers of institutional inter-linkages and institution-performance linkages.

Second, the study defines a set of variables to capture the institutional and performance aspects. Some of the major layers of institutional inter-linkages and institution-performance linkages are formally modeled as a set of inter-linked equations. The constant terms in these equations are considered to capture the combined effects of the general environment facing the process of institution-performance interaction within water sector. Since the general environment is defined as socio-economic, political, legal, and environmental factors that are outside the strict confines of water sector, it

captures the intervening effects of factors exogenous to the water sector. In this way, the equations capture the effects of both the endogenous as well as exogenous factors.

And, finally, for the empirical estimation of the equations, this study relies on an innovative evaluation methodology based on a cross-country survey of 43 water sector experts having different disciplinary background and professional orientation from 11 countries with diverse water problems, socio-economic settings, historical traditions, and political arrangements. While this methodology is nothing new, the justification for its legitimacy provided in this study is, however, new. Unlike the past studies, this study justifies this approach not so much in terms of data difficulties but in terms the subjective nature of institutions recognized repeatedly in the institutional economic literature. That is, institutions are inherently subject in nature because they are human creations for increasing transparency and reducing uncertainty in human interactions and hence, they exist, evolve, and interact with human beings. This fact justifies the use of executive perception as a legitimate basis for institutional evaluation.

Both to demonstrate the robustness of the evaluation methodology as well as to facilitate the better interpretation of the policy implications of this study, it is useful to provide here the gist of the regression results. The empirical evaluation focuses on various layers of the institutional inter-linkages and institution-performance linkages evident in the process of institution-performance interaction within water sector, the results are organized following the same structure.

First, as to the institutional inter-linkages within each of the three water institution components. The results could identify some of the legal, policy, and administrative aspects that dominate the current debate on water institutional reform. As per the results, among the seven legal aspects considered for evaluation, only four are important in determining the performance of water law. These legal aspects are: the effectiveness of conflict resolution provisions, the degree of internal consistency within water law, the integrated treatment of water sources, and the scope for private sector participation. Even among these four legal aspects, the first two have a relatively stronger effect on water law performance as compared to others. Among the seven policy aspects considered, only four are significant in explaining water policy performance. These policy aspects are: the degree of economic orientation of project selection criteria, the level of cost recovery, the linkage between water policy and other policies (e.g., agricultural, fiscal, and trade policies), and the overall linkage between water law and water policy. In terms of relative importance, cost recovery comes first followed then by law-policy linkage and policy inter-linkages. Among the seven administrative aspects considered, only two aspects, i.e., the balance in functional specialization and the existence of an independent body for water pricing, have a dominant role in determining the overall performance of water administration.

Second, the institutional inter-linkages within water institution are evaluated by relating the overall performance of water institution first with the performance of its three constituent components and then with some of the selected institutional aspects from each of these three water institution components. The results for the first case show that the overall performance of water institution depends more on the performance of its policy

and administrative components than on the performance of its legal component. The results for the second case show that of the 16 institutional aspects considered for evaluation, only four become significant in explaining water institution performance. These institutional aspects given in the order of their relative importance are: the degree of balance in functional specialization, the existence of an independent body for water pricing, the linkages between water policy and other policies, and the legal scope for private sector participation.

And, finally, the institution-performance linkages are evaluated by relating water sector performance first with the performance of the three water institution components and then with the 16 institutional aspects underlying the performance of these three water institution components. The results, in the first case, show that water sector performance is linked more to the performance of water law and water policy than to water administration. The results, in the second case, identify the following institutional aspects to be major determinants of water sector performance. These institutional aspects given in the order of their importance are: the integrated legal treatment of water sources, the existence of an independent body for water pricing, the balance in functional specialization, the legal scope for private participation, and the seriousness of budget constraint. More importantly, the results in almost all cases also show that the constant term capturing the effects of the general environment as defined by the exogenous factors is not only significant but also positive. Some of the major policy implications emanating from the empirical analysis are noted below.

As to the policy contributions of this study, its analytical framework is itself important for the purpose of developing strategies for institutional reform within the water sector strategies. Since the analytical decomposition of both water institution and water sector performance provides a sound framework for understanding of the inner dynamics of the process of institution-performance interaction within water sector, it proves to be the starting point for framing institutional initiatives in the water sector. Although the analytical framework developed here is more generic and useful for planning institutional reform from an international perspective, country level planning, however, requires its adaptation to country-specific contexts to take stock of regional variations and unique situations. In addition to the policy implications of the analytical approach, the regression results also provide key inputs for the strategy of institutional reform in the water sector. The policy contributions of the empirical results are as follows:

First, since the estimated coefficients of the equations indicate the relative strength, direction, and significance of the performance impact of institutional components and institutional aspects, they can be used as basis for identifying some of the most desirable features of a performance-oriented water institution. In general terms, an ideal water institution needs to have a water law that treats all water sources within an integrated framework, has effective conflict resolution provisions, reveals higher degree of internal consistency, and provides scope for private sector participation. Similarly, it is desirable to have a water policy centered on economically-based project selection

criteria, full cost recovery, strong ties with other economic policies, and close links with water law. Likewise, the most desirable features of water administration are the balance in functional specialization and the existence of an independent body for water pricing. These features set the priorities for institutional reform in a generic context.

Second, the institutional aspects identified to be the dominant features of an ideal water institution do not, however, imply that other institutional aspects are less important. In view of the intricate linkages among institutional aspects and the resultant difficulty in isolating the individual effects of various legal, policy, and administrative aspects, it is entirely possible that the effects of some aspects may be either picked up by or mixed up with those of the others. In the first case, the significant institutional aspects actually capture also the joint effects of a set of other related institutional aspects. However, in the second case, institutional aspects, which are significant at an individual level, can become insignificant in a collective context where they are combined with other ineffective institutional aspects. From a policy perspective, therefore, it is necessary to recognize the institutional and performance linkages that the identified set of desirable institutional features has with others.

Third, although all water institution components and its constituent institutional aspects are interrelated and hence, equally important, the observed variations in the size and significance of their estimated coefficients in different evaluation contexts clearly suggest that they differ in terms of their institutional linkages and performance impacts. Since their differential effects reflect essentially the role of both time lag and operational proximity, it is reasonable to order and sequence the institutional aspects in terms of their instantaneous effects and immediate linkages as indicated by the size, direction, and significance of the variables representing them. Such an ordering provides a very valuable basis both for institutional design as well as for its sequential implementation. Given an initial institutional design, the general guideline for its implementation involves the identification of institutional aspects having both the most immediate return in terms of improved water sector performance as well as the most intimate operational linkages with other institutional aspects which are next in the hierarchy of importance. In this way, the implementation of each institutional aspect improves water sector performance even while creating a favorable climate for the implementation of subsequent institutional aspects.

Fourth, the significant positive effect that the constant term has in most contexts suggests clearly the synergy that the institution-performance interaction can derive from the general socio-economic, political, and resource-related environment within which such an interaction occurs. With an overall pro-reform climate, it is possible not only to minimize the overall transaction cost of institutional reform but also to achieve more than proportionate improvement in water sector performance with a given level of institutional change. The significance of the exogenous factors also suggest that the institutional reforms within water sector need to be approached in a broader context to exploit well the synergy generated by prior, concurrent, and subsequent changes elsewhere in the economy. This also suggests the role that timing of water institutional reforms implementation play in determining their effectiveness and impact.

Finally, the results strongly favor a sequential strategy for institutional reform in general and water institution in particular. The main rationale for this strategy lies in the tremendous scope for gainfully exploiting the synergy that emerges from both within and outside the water sector. While the strategy of institutional reform at-one-go is economically costly and politically difficult, effecting gradualistic changes within an ordered and sequential framework enhance the feasibility and effectiveness of institutional change in most situations. Since the institutional synergy reduces the transaction costs of subsequent reforms, and the immediate performance impacts of initial reforms ensures a steady flow of economic benefits, the sequential strategy enhances the prospects for institutional change by gradually weakening political resistance even while precipitating an endogenous pressure for further reforms. The sequential strategy is also more suitable for international lending agencies such as the World Bank with an avowed interest in promoting institutional change in the water sector worldwide. Since this strategy provides a natural framework for temporally and operationally linked long-term lending programs in the institutional sphere of water sector, it is mutually advantageous for both the borrowing countries and the lending agencies.

To conclude, the present study does break new grounds both in terms of its analytical approach and methodological innovation as well as in terms of its policy insights into the process of institution-performance interaction. But, further research is needed to improve the policy value and credibility of this study by extending the analysis in two main directions. First, the empirical basis of the analysis has to be broadened by increasing the sample size--both by adding more countries and water sector experts--and incorporating, thereby, a greater diversity in the context and perception of the institution-performance interaction. Second, the evaluation has to be extended to cover also the layers of interaction among institutional aspects within each water institution component (e.g., the relationship among the legal aspects such as conflict resolution, water rights, and accountability). And, finally, the estimation procedure has to be refined to evaluate together the intricate linkages among various layers of the institution-performance interaction within a sequential or simultaneous system framework. Since a simultaneous estimation can isolate and trace the effects of any institutional aspects throughout the system, it allows the identification of a more accurate institutional design and sequencing than that possible at present. With a well designed and sequential strategy that exploits better the institutional inter-linkages and synergy, the political economy constraint that persists because of an inadequate understanding of the process of institutional change, can be relaxed, and even, be turned into an imperative for change.

INTRODUCTION

Physical limits to fresh water expansion--an emerging reality in many parts of the world--make absolute water scarcity inevitable. The inability of the already developed water supply to meet an ever-growing demand for fresh water also makes the emergence of relative water scarcity unavoidable. Water scarcity--both in its absolute and relative forms--gets accentuated further by an increasing premium attached to water quality and ecological sustainability. The multifarious economic and political consequences of water scarcity--including the widespread occurrence of inter-regional and inter-sectoral water conflicts--have heightened the need for creating flexible but effective water allocation and management mechanisms. The creation of allocation-centered institutional mechanisms of the kind needed to tackle water scarcity on a continuing basis is not an isolated task. It warrants a rather radical restructuring of the whole gamut of institutional arrangements that govern various facets of water sector like water resource development, allocation, utilization, and management. Such an institutional restructuring obviously entails concurrent reforms in the legal, policy, and administrative spheres of the water sector.

Institutional reform of the magnitude required at present is obviously a daunting challenge in most countries with outdated and poorly functioning water institutions. While policy-makers realize the heavy socio-economic costs of the prevailing institutional inadequacy within the water sector, the political economy constraints remain a powerful obstacle for initiating any substantive institutional reform. This adds an additional dimension to the task of promoting institutional change, i.e., the identification of a politically more acceptable reform strategy. Fortunately, in addition to the positive influence of the progress in water and information technologies, two powerful factors enhance the prospects for water institutional reforms in most countries. First, the economic benefits likely to be realized from an allocation-oriented institutional change are not only substantial but also increasing with increased water scarcity. Such benefits, though difficult to quantify exhaustively, can be conceptualized in general terms as improvements in overall water sector performance. And, second, the cost of transacting institutional reform in a given political economy context can be minimized and the usual inertia associated with the stupendous nature of the reform task can be overcome through a gradual but sequential reform strategy. Since such a strategy continuously builds on the synergy generated by undertaking selected reforms in key institutional components, subsequent reforms become easier to transact both politically and institutionally. Taken together, these two factors also have the additional effect of offsetting residual political resistance.

The identification of a sequential strategy for water institutional reform requires a much closer evaluation of the two main dimensions of the process of institution-performance interaction within water, i.e., the institutional inter-linkages and institution-performance linkages. Such an evaluation, if performed within an analytical framework capable of capturing well the institution-performance interaction and an empirical context amenable for generalization, can provide immense policy insights into the relative significance of various institutional components in terms of the nature and magnitude of

their institutional inter-linkages and performance effects. The relative significance of institutional components including their linkages and performance impact can enable the establishment of a prioritization scheme where institutional components and sub-components are ordered in terms of their performance impact and political acceptability. Given such a prioritization scheme, it is rather straightforward to outline not only a blueprint of a performance-oriented water institution but also a sequential strategy for its implementation with a minimum transaction costs but maximum performance benefits.

Unfortunately, existing literature on the subject--both theoretical and empirical--provides little guidance as their focus is either too narrow to consider water institutions as a whole or too descriptive or anecdotal to provide any quantitative evaluation. This limitation of the existing literature is understandable for two reasons. First, most studies have either ignored or underestimated the strategic roles of the critical linkages evident among institutional components (e.g., the linkages between property rights system and conflict resolution capabilities or the extent of water technology and information application and enforcement/monitoring capabilities of water administration). And, second, the inherent difficulties in quantifying institutional issues and obtaining the right kind of data have discouraged the attempt for a quantitative evaluation of water institution and their performance impacts.

While the analytical challenges and empirical difficulties are too real to discount, the strategic value of a quantitative institutional inquiry within the water sector provides the urge to venture into this uncharted course of policy research. The present study aims to make a modest beginning in this critical but least explored area of institutional research. It develops first an evaluation methodology that analytically decomposes water institution and water sector performance to identify some of their major components. It functionally links these components to formally characterize the institutional inter-linkages and institution-performance linkages within water sector. It utilizes an innovative cross-country survey of international water sector experts to obtain both factual and perceptional information on all relevant variables. Finally, utilizing the evaluation methodology and the survey information, this study attempts a quantitative evaluation of both the institutional inter-linkages and institution-performance linkages within the water sector to derive significant implications for both theory and policy. More specifically, the main objectives of this study are to:

(a) delineate an analytical framework capable of capturing the operational linkages both within and among different water institutional components as well as between water institutions and water sector performance;

(b) develop an evaluation methodology to functionally link some of the major water institutional components both with themselves as well as with water sector performance;

(c) demonstrate the practical utility of the methodology for the quantitative analysis of both the institutional inter-linkages and the institution-performance linkages with its empirical application in a cross-country context;

(d) identify the relative significance of various institutional components in terms of the nature and strength of their institutional and performance linkages and synergy;

(e) outline the desirable characteristics of a performance-oriented water institution including the identification of some key features of a strategy for its sequential implementation; and

(f) conclude by identifying key implications for both water institution theory and water sector policy.

It is useful to note that the study is also organized, more or less, on the lines of this sequentially linked set of objectives.

ANALYTICAL FRAMEWORK

The analytical framework underlying the evaluation methodology involves three steps. First, the concepts of 'water sector', 'water institution', and 'water sector performance' are defined to set the broad contour of analysis. Second, water institution and water sector performance are conceptually decomposed to identify some of their major components and sub-components (or, aspects). And, finally, the decomposition exercise is used as a basis to analytically highlight various layers of institutional inter-linkages and institution-performance linkages evident within water sector.

Water Sector and Water Institution: Conceptual Basis

For the purpose of this study, water sector is considered to cover all consumptive uses of water like irrigation, domestic consumption, and industrial use from both surface and sub-surface sources as well as reclaimed or recycled sources. The non-consumptive uses such as power generation, navigation, and ecological water needs are considered but only to the extent they influence the dominant consumptive uses either directly or indirectly. Although the macro perspective entailed by a broader concept of water sector involves an obvious sacrifice of micro details, such a perspective is taken deliberately to sharpen the focus on the main thrust of this study, i.e., the evaluation of the process of institution-performance interaction within water sector.

Consistent with the institutional economics literature, institution is conceived in a much broader sense than mere organization. Since institutions set the rules of the game and define, thereby, what individuals can and cannot do in given context, they, in effect, delineate the action sets for both individual and collective decision-making (Commons, 1968; Bromley, 1989a and 1989b; North, 1990). Institutions are influenced by a variety of factors such as historical precedents, constitutional provisions, political arrangements, demographic conditions, resource endowment, and economic development. Since the influence of these factors is formalized into three inter-related aspects, i.e., legal frameworks, policy issues, and administrative arrangements, institution can be conceptualized as an entity defined interactively by three main components, i.e., law, policy, and administration. Specializing such a general notion of institution to the

particular context of water sector, water institution can be characterized in terms of water law, water policy, and water administration.[1] As in the case of water sector, water institution is also approached from a national perspective. Besides, water institution as used in this study covers only its formal dimensions, i.e, formal water law, water policy, and water administration but excludes their informal counterparts such as conventions, customs, and administrative traditions. Since the formal dimensions of water institutions, unlike their informal counterparts, evince remarkable stability and regional similarity, they are more opt for the purpose of establishing an internationally comparable standard characterization and decomposition.

Water Institution: Analytical Decomposition

The analytical decomposition of water institution is done at two stages. First, water institution is decomposed into three broad *institutional components*, i.e., water law, water policy, and water administration. And, then, each of these institutional components is decomposed further to identify its constituent *institutional aspects*.[2] While it is easy to identify all the institutional aspects involved in each of the three institutional components of water institution, it is rather difficult to consider all of them within a single and tractable framework. For a focused and manageable evaluation, therefore, it is necessary to concentrate on some of the major institutional aspects. It is desirable from a policy perspective that the institutional aspects selected for a focussed treatment are those which are noted frequently as the key factors influencing the overall performance of both water institutions and water sector. The institutional aspects that are finally selected under each of the three institutional components of water institution are given below.

The **Water law** component of water institution includes the following law-related institutional aspects:

(a) Legal treatment of water and related resources,
(b) Format of water rights,
(c) Provisions for conflict resolution,
(d) Provisions for accountability,
(e) Scope for private sector participation,
(f) Centralization tendency, and
(g) Degree of legal integration within water law.

The **water policy** component of water institution includes the following policy-related institutional aspects:

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[1] Note that water institution is also influenced by the non-water-related legal, policy, and administrative aspects (e.g., constitution, and land and environment laws, agricultural and fiscal policies, and agricultural and credit administrations). As such, the influence of these aspects has also to be taken into account when dealing with water institution.

[2] Notice the way the concepts of 'institutional components' and 'institutional aspects' are used in this study. While the former is used to denote a broader decomposition of water institution, the latter is used to denote a further decomposition of the three water institution components. Thus, the latter can also be used to denote a finer decomposition of water institution per se.

(a) Project selection criteria,
(b) Pricing and cost recovery,
(c) Inter-regional/sectoral water transfer,
(d) Private sector participation,
(e) User participation, and
(f) Linkages with other economic policies.

The **water Administration** component of water institution includes the following administration-related institutional aspects:

(a) Spatial organization,
(b) Organizational features,
(c) Functional capacity,
(d) Pricing and finance,
(e) Regulatory and accountability mechanisms, and
(f) Information, research, and technological capabilities.

As can be seen, the institutional aspects selected for evaluation here capture some of the policy issues that dominate the current debate on water sector reform. These issues are: integrated water resources management, conflict resolution, accountability, financial viability, decentralization, and capacity building within water sector. All these issues also have a strong bearing on the overall performance of both water institution and water sector. The coverage of water institutional aspects can, therefore, be considered adequate to evaluate most of the currently relevant policy issues operating in the interface between water institutions and water sector performance.

Besides these institutional aspects, there is also a need for a set of **performance aspects** to capture the overall effectiveness or performance of not only each of the three institutional components but also water institution taken as a whole. They are as follows:

(a) Overall effectiveness of water law,
(b) Overall effectiveness of water policy,
(c) Overall effectiveness of water administration, and
(d) Overall effectiveness of water institution.

The overall effectiveness of each of the three institutional components depends not only on the effectiveness of its constituent institutional aspects but also on the strength of their linkages with other institutional components. Similarly, the overall effectiveness water institution depends on both the individual and interactive effects of the performance levels of the three institutional components. In this way, the overall performance of water institution is linked ultimately to both the individual and joints effects of the institutional aspects underlying all the three institutional components. In addition to the direct impact of institutional components and their underlying institutional aspects, the performance of water institution is also influenced by the general socio-economic, political, and resource-related environment within which it operates.

Although the overall performance of water institution is relatively more difficult to conceive and measure as compared with that of its components, it is, however, possible to capture it indirectly in terms the progressiveness of water institution. Broadly

speaking, the progressive nature of water institution can be conceived in terms of four inter-related factors, i.e., adaptive capacity, scope for innovation, openness for change, and ability to tackle emerging problems. While adaptive capacity is indicative of the flexible nature of water institution to change with time and space, the scope for innovation allows it to acquire new and more appropriate institutional structure and get itself updated constantly. Similarly, the openness for change suggests the absence of institutional rigidity within water institution and the ability to tackle emerging problems indicates its performance efficiency even with changing resource realities within water sector. Obviously, all these factors are fundamentally interrelated in the sense that the openness of water institution for change is a basic condition for ensuring its adaptive capacity and innovation potential, and all these three factors are indispensable for creating a flexible and performance-oriented water institution.

Given the decomposition of water institution and its performance outlined above, it is possible to link--both analytically and functionally--the performance of each institutional component with their constituent institutional aspects. Similarly, the overall performance of water institution can also be linked not only with the performance of institutional components but also with the institutional aspects themselves. In this way, the analytical decomposition exercise outlined above provides a framework for evaluating both the institutional inter-linkages as well as institution-performance linkages within water sector.

Water Sector Performance: Analytical Decomposition

Rigorous performance criteria have been developed and applied at the level of particular projects within the irrigation sub-sector (e.g., Sampath, 1990; Bos, 1997; Burt and Styles, 1997; Brewer, Sakthivadivel, and Raju, 1997; Renault, 1998). But, the same cannot be said about the criteria needed for an evaluation of the overall performance of water sector taken as a whole. Efforts to develop objective and internationally comparable economic and equity criteria are severely constrained both by the data and methodological problems involved in capturing the economic or scarcity value of water as well as by the subjective issues inevitable in evaluating equity performance. While there are indicators for the physical gap (i.e., between water demand and supply) and financial gap (i.e., between water charges and supply cost), their aggregate/sector-specific nature and data problems limit their ability to serve as objective criteria for the overall water sector performance.

Even with well-developed objective performance criteria, water sector performance cannot be evaluated in all its dimensions due to the presence of crucial subjective but very pertinent aspects of performance such as the smoothness of water transfers and the adaptive ability of water institution. Although the number of water conflicts can be used as a proxy for the smoothness of water transfers, it is not clear how the relative seriousness of such conflicts can be factored into the evaluation. Similar is also the case with the extent of science and technology application because the number of scientific and technical instruments need not necessarily reflect the effectiveness with which they are used. Even in cases where objective criteria are available or theoretically

possible, subjective aspects (in the sense of learned judgements of experts) are still inevitable either to substitute or supplement prevailing knowledge. Since water sector performance is an entity having both physical, financial, economic, and equity dimensions, it is logical to decompose it in terms of these four performance dimensions or components. The performance aspects selected under each these four performance components of water sector performance are listed below.

The **physical performance** of water sector is evaluated in terms of the following aspects:

(a) Demand-supply gap,
(b) Physical health of water infrastructure,
(c) Conflict resolution efficiency (low-cost and less time), and
(d) Smoothness of water transfers across sectors/regions/users.

The **financial performance** of water sector is evaluated in terms of the following aspects:

(a) Investment gap (actual vs. required) and
(b) Financial gap (expenditure vs. cost recovery).

The **economic efficiency** of water sector is evaluated in terms of the following aspects:

(a) Pricing gap (water prices vs. supply cost) and
(b) Incentive gap (water prices vs. scarcity value of water).

And, finally, the **equity performance** of water sector is evaluated in terms of the following aspects:

(a) Equity between regions,
(b) Equity between sectors, and
(c) Equity between groups.

One issue deserves special mention partly because of its significance and partly as an instance for the inter-dimensional synergy evident among performance components. This is the mutual performance impact of physical, financial, economic, and equity components. For instance, the pricing and cost recovery aspects have an influence on the physical health of water infrastructure via their implications for the ability to fund maintenance and system improvement activities on a regular basis. Similarly, an enhanced service quality as induced by a healthy water infrastructure is likely to facilitate a better recovery of costs. Likewise, efficient conflict resolution mechanisms can ease the process of inter-sectoral and inter-regional water transfers and contribute, thereby, to a more efficient and equitable allocation of water resources. Besides their financial implications, efficient water prices can also contribute to water use efficiency and conflict resolution. Similar kinds of inter-dimensional synergy among the water institution components and institutional aspects have already been discussed in the context of the analytical decomposition of water institution. It is in view of its ability to capture such linkages that the analytical framework developed from a detailed decomposition of water institution and water sector performance becomes important as an analytical tool for a systematic evaluation of the institution-performance interaction within the water sector.

Water Institution and Water Sector Performance: Analytical Linkages

With the analytical decomposition of water institutions and water sector performance, it is now possible to demonstrate their analytical and operational linkages. To distinguish the linkages with water institution (i.e., the linkages among water institution components and aspects) from those between water institution and water sector performance, the former are denoted as institutional inter-linkages whereas the latter are denoted as institution-performance linkages. As stated already, these two sets of linkages constitute actually the two main dimensions of the process of institution-performance interaction within water sector. Since the institutional inter-linkages are the underlying causes for the institution-performance linkages, it is logical to begin with the former. In this respect, it is useful to recognize certain special features of the linkages among the three components of water institution. Although water law and water policy are related, it is difficult to establish whether water law precedes or succeeds water policy as history provides evidence for both cases. But, in any case, neither of them can be effective without the other in view of their mutual feed backs and adjustments occurring through time. Under ideal conditions, water law empowers water policy and water policy, in turn, provides a political economy translation for water law. Taken together, they define the framework and determine the capacity of water administration that actually implements the legal and policy provisions at the field level. Intuitively speaking, water law and water policy form the software component of water institution whereas water administration forms as the hardware component of water institution.

The overall performance of water institution and its ultimate impact on water sector performance depends not only on the capabilities of its individual components but also on the degree of integration evident among them. The degree of integration within water institution can be formalized in terms of the strength of institutional inter-linkages. An illustrative set of these institutional inter-linkages is depicted in Figure 1. To begin with, the legal aspects related to the way different water sources as well as their linkages with other resources, such as land and environment, are legally treated have an influence on water policy aspects such as the prioritization of water sources and project selection criteria. For instance, a water law that does not discriminate water by its source but does recognize the ecological linkages between water and other resources is more likely to encourage a water policy that assigns a higher priority for environmental imperatives and hydrological inter-connectivity in project selection. Such a legal-policy linkage also creates a favorable institutional environment for promoting an integrated approach to water resource management. This particular linkage also indicates the way in which water law and water policy are influenced by the laws and policies relating to other resources like land and environment.

The most important legal aspect having multiple linkages with other legal, policy, and administrative aspects is related to water use rights. It reinforces further the effects of the already inter-related legal aspects of conflict resolution and accountability. It also influences the water policy through its effects--both implicit and explicit--on policy aspects such as water pricing, cost recovery, management decentralization, and private sector participation. The three legal aspects related respectively to water rights, conflict

resolution, and accountability also have a strong effect on water administration. This is because their implementation requires special administrative mechanisms and functional capabilities. Taken together, they also determine the regulatory powers of water administration. Different policy aspects also influence water administration. The most important among them are the policy aspects involving user participation, management decentralization, and private sector participation. These policy aspects can strengthen water administration by tapping private skills and funds even while contributing to staff reduction and de-bureaucratization. Water policy with regard to the application of water, information, and management technologies contributes to skill formation and capacity building within water administration. Besides the institutional inter-linkages noted here, there are also many more linkages--both straightforward and subtle--that are equally important in determining the overall performance of water institutions.

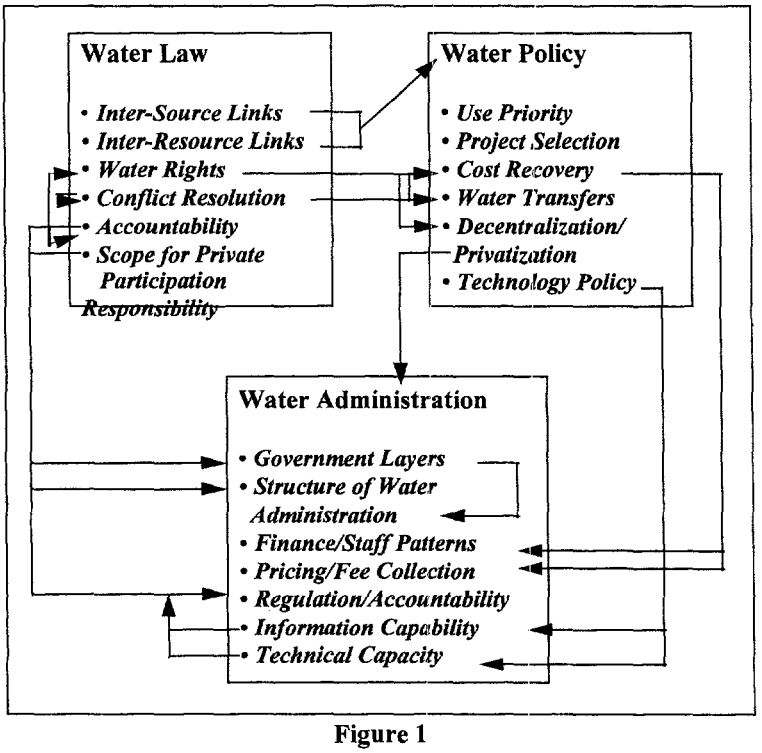

Figure 1
Water Institution: Illustrative Inter-linkages

For a better understanding of the institution-performance linkages, it is necessary to recognize two factors, i.e., the specific role of institution and the intervening influence of factors that are strictly outside the realm of both water institution and water sector. Since the main role of institutional arrangements is to structure the incentive system in vogue, they underpin the operation of the allocation mechanisms and guide water resource allocation and utilization on a continuing basis. Thus, the performance impact of an institutional arrangement depends critically on its incentive properties and allocation abilities. This applies equally to water institution. In view of its deep operational linkages with the incentive structures and allocation mechanisms, water

institution has a strong and direct impact on water sector performance. The strength of the performance impact of water institution depends, of course, on the efficacy of its individual components as well as the degree of integration among those institutional components themselves. Moreover, the overall context in which the institution-performance linkages are evaluated also exerts a strong influence on the strength of the performance impact of water institution. Given the influence of exogenous factors such as political condition, economic development, demographic growth, and resource scarcity, an institutional arrangement with stronger incentive features and integration properties is likely to yield a better water sector performance as compared with others. The operational implication of this fact, which forms the basic logic behind the institutional approach to water resource management, is that water sector performance can be improved through induced changes in water institutions. The nature of the institution-performance interaction within water sector can be explained using Figure 2.

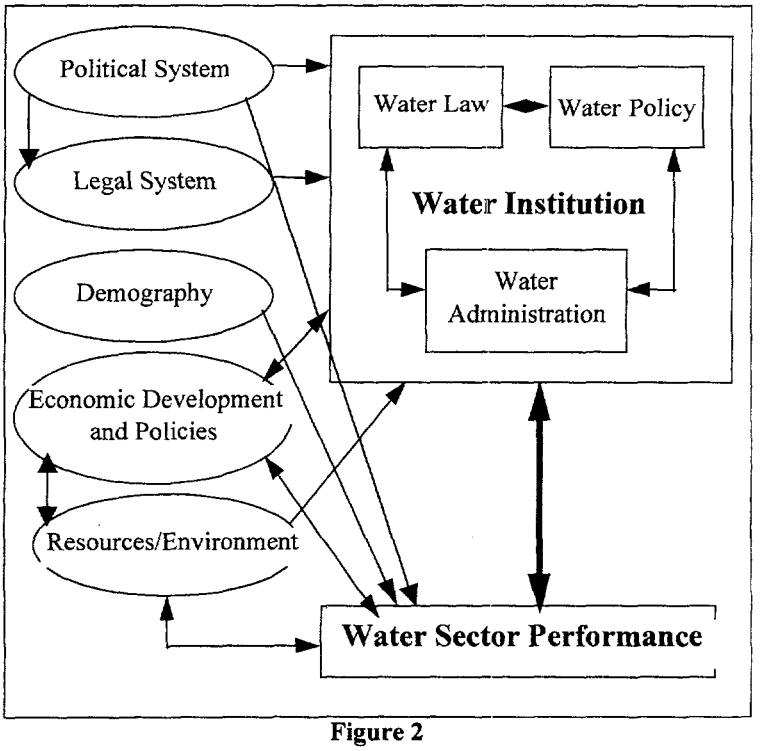

Figure 2
Water Sector: Institution-Performance Linkages

Figure 2 has two parts, the institution-performance interaction within water sector and the general context within which such interaction occurs. Taking first the institution-performance interaction, notice the two-way arrow that links water institution and water sector performance. While institutions do influence water sector performance through the economic medium, both the nature of the water sector and the level of its performance influence water institution through the hydro-geological and political mediums. This two-way linkage has three major implications. First is the role of economic factors in initiating institutional change in water sector. Next is the role of hydro-geological factors

in explaining institutional variations across countries and regions. Since water institutions are shaped by the nature of water sector, they are not entirely independent of the basic characteristics of the water sector itself. Thus, water institutions in areas with water abundance differ obviously from those in areas with acute scarcity. The last one is the role of water sector crisis in building political pressure for institutional change. The crisis-induced institutional responses observed now in most countries do provide evidence for the central role of political pressure (see Saleth and Dinar, 1999). The political impact of the hydrological phenomenon of water crisis has an underlying economic urge for change as well. With a crisis-ridden water sector, the marginal benefits of institutional change in terms of improved performance become very high relative to both the real and monetary costs of transacting the institutional change. This provides a welfare theoretic logic for initiating changes in the institutional arrangements governing water sector. Although the incremental net benefits from institutional change can decline as water institution matures over time, they are quite high in the initial stages of institutional evolution.[3]

The context within which the institution-performance interaction occurs is as important as its mechanics because of its effect on the two-way linkages between water institution and water sector performance. In reality, the general context or the environment is defined by an inter-play of innumerable factors that are strictly exogenous to the water sector. But, for analytical convenience and simplicity, Figure 2 focuses only on the most important among them such as the political system, legal framework, economic development, demographic condition, and resource endowment. Although these factors are themselves inter-related, for expositional purpose, Figure 2 highlights only the nature of their relationship with the process of institution-performance interaction. While the political system and legal framework affect mainly the structure of water institution, the other factors influence and are also being influenced by water sector performance. Since these factors represent the exogenous constraints and opportunities, they play a major role in shaping both the nature and character of the institution-performance interaction within water sector.

Although institutional differences provide the major explanation for variations in water sector performance, the general context of the institution-performance interaction is still important for providing residual explanations.[4] In many instances, the context can even explain better the reasons as to why similarly placed water institutions (or its

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[3] The evaluation of the benefits and costs of institutional change is often blurred in view of the political context in which the exercise is being done. Because of the myopic calculus, the transaction costs--both real and monetary--are overestimated while the benefits stream that continues over a longer time span and spills over far beyond the water sector are underestimated. However, the point being made here takes purely an economic stand with a welfare theoretic perspective.

[4] Regarding the important role that the social and political contexts play in determining the effectiveness of institutions in general, North (1990:101) notes that the adoption of either the US constitution by many Latin American countries or the western property rights laws by many developing countries has not been successful because "the enforcement mechanism, the norms of behavior, and the subjective model or models of the actors are not the same". This means that institutional similarity does not necessarily assure performance consistency across contexts.

components) lead to a differential water sector performance. The performance variations in the turn-over policy across countries (see Johnson, 1997; Vermillion, 1997) and basin level organizations (see Kliot et al., 1997) are cases in point. These instances show that political and legal commitments to declared policies, though necessary, are not sufficient in the face of administrative inadequacy and other bottlenecks including the structural basis of political system (e.g., federal vs. unitary form or presidential vs. parliamentary form).

The economic factors including macro economic reform and trade policy change also play a strong role in providing impetus for institutional changes within water sector. The success of the turn-over program in Mexico, the extensive water sector reform initiated already in China, and the growing policy attention to water sector reform in India can all be traced to their macro economic reforms of the late 1980s (Saleth and Dinar, 1999). Almost similar is also the role of environmental factors including drought and floods as illustrated by the cases of California and China respectively. These instances for the powerful role that exogenous factors play in process of institution-performance interaction within water sector clearly underline the need to incorporate within the evaluation framework both the synergy as well as discord emanating from both within and outside the water sector.[5]

EXISTING LITERATURE: A METHODOLOGICAL REVIEW

To provide background and set contrast for the methodology to be used in the present study, it is useful to review a subset of existing studies in the institutional economics literature that try to empirically evaluate the issue of institution-performance interaction both in general and in water sector contexts. The focus of this review is mainly on three aspects, i.e., the dimensions of the institution-performance interaction being evaluated, the nature of the variables being developed to capture institutional aspects, and the methodological framework and evaluation context being used by the existing studies.

To begin with, a temporal analysis is used by Wallis and North (1986 and 1988) to study the size, structure, and implications of the 'transaction sector' (i.e., the institutional structures that facilitate, enforce, and maintain economic exchanges within the market setting) in the US during 1870-1970. Adelman and Morris (1974) and Adelman and Lohmoller (1994) combine both temporal and cross-section analysis to study the impact of political structures and economic institutions on economic growth in the context of 23 countries during 1850-1914. The study by Adelman and Lohmoller (1994) is particularly important in view of its methodological implications for the purpose of the present study. It evaluates the institution-performance interaction within a quantitative framework using a latent variable regression model where many latent or

[5] One way of conceptualizing and analytically tracking the influence of these exogenous factors is to consider their effects both on the social benefits and transaction costs of institutional change. While political and legal factors have a dominant role in determining the transaction costs, others have a larger role in defining the social benefits from institutional changes within water sector.

unobservable institutional variables are captured by their relationship with manifest or observable variables. Most of the latent variables (e.g., the character of national political leadership, favorableness of land institutions to improvements, and the spread of technology in different sectors) have also been formulated as categorical variables with categories ordered based either on actual evidence or on a priori reasoning (Adelman and Lohmoller, 1994:351-354).

A combination of temporal and cross-sectional analysis has also been used for studying both general as well as specific aspects of institution-performance interaction. For instance, the study by Remmer (1998) uses this hybrid approach to evaluate the relationship between democracy and international cooperation in the Mercosur region (comprising of Argentina, Brazil, Paraguay, and Uruguay) during 1947-85. While the actually observed economic and international treaty data are combined to quantitatively evaluate the democracy-cooperation linkages within a logit regression framework, the main dichotomous variable, i.e., democracy, has been created using secondary information from a comparative research on Latin American democracy. There are also theoretical and analytical studies addressing particular aspects of the institution-performance interaction such as the relationship between organizational performance and economic development status (e.g., Clague, 1994) and the role of state in building new institutions and managing conflicts during the process of structural change (Chang, 1994). Although these issues can be addressed quantitatively, since these two studies use a cross-section of only a few countries, they evaluate these issues only theoretically within an analytical framework.[6]

There is another interesting set of studies which show how data problems inherent in an empirical evaluation of institution-performance interaction can be overcome by combining subjective information with objective data particularly within cross-sectional contexts. As for instance, in their logistic regression-based cross-country study of institutions and economic performance, Knack and Keefer (1986) combine observable variables like investment, gross domestic product, and prices with subjectively evaluated institutional variables like quality of bureaucracy, corruption level, expropriation risk, and infrastructure quality. They obtain these institutional variables--evaluated within a 0-10 or 0-4 scale--from the compilation of private professional bodies providing international investment risk services such as the International Country Risk Guide and Business Environment Risk Intelligence. These investment service firms, in turn, develop these institutional indicators based on a survey of international executives. Similarly, Gray and Kaufmann (1998) evaluate the linkage between corruption and development in a cross-country context utilizing the executive perception-based institutional information compiled by the World Economic Forum (1997).[7]

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[6] This is not, however, to undermine the importance of these and other similar studies but to illustrate how the subject of enquiry, evaluation context, data problems, and evaluation techniques are inter-related. This is particularly so in the case of institution-performance interaction because of an innate difficulty in quantifying an essentially qualitative and subjective phenomenon.

[7] For instance, the 1997 Global Competitiveness Report of the World Economic Forum has compiled and processed the responses from 3000 firms in 59 countries.

Cukierman, Webb, and Neyapti (1992) have studied the nature of the relationship between the degree of independence of central banks and the level of inflation within a regression framework. Thier study provides an interesting case not only for combining temporal and cross-sectional analysis but also for obtaining institutional information from a cross-section of policy experts through a custom-made questionnaire. While their dependent variable, i.e., inflation, is observable and objective, their independent variable, i.e., the independence of the central bank, is reflected by a set of coded and appropriately weighted legal aspects pertaining to the functioning of the central bank and its top executive. Notably, the survey of experts in 23 of the 72 sample countries has been used to obtain both parallel information as well as perceptional weights on all relevant institutional variables. Brinkerhoff (1994) evaluates the effects of institutional design features on the performance of projects by considering a random sample of 80 World Bank-funded projects undertaken in different countries during 1983-90. The scope of this study is confined to a cross-section of projects and its evaluation technique is limited to a statistical analysis of tabulated data. Nevertheless, it is notable for its detailed analytical decomposition of institutional design features as well as for its use of a rating scheme for the numerical conversion of some of the institutional aspects on a scale of –3 to +3.[8]

Both the general and specific aspects of the linkages between water institutions and water sector performance have been recognized widely either within a theoretical, anecdotal, or case study framework (e.g., Hartman and Seastone, 1970; Dinar and Latey, 1991; Frederiksen, 1992; Guggenheim, 1992; Le Moigne, et al., 1992 and 1994; Gazmuri and Rosegrant, 1994; Hearne and Easter, 1997; Howitt, 1998). While the scope, purpose, and methodology of these studies vary, the common element binding them together is their focus on the performance implications of one or more aspects of water allocation and management institutions. But, there is hardly any study that either posits or evaluates the issue of institution-performance interaction in the water sector with such a broader perspective as outlined in Figures 1 and 2. However, there are few studies that evaluate some of the aspects of this interaction using different evaluation contexts and methodologies.

Wade (1982) compares the yield and employment performances of irrigation water control institutions (i.e., the water distribution system and allocation procedure) in Southern India with that in Korea within an essentially descriptive and non-quantitative framework. The better performance of Korea is explained in terms of a better water supply, small, decentralized, and demand-controlled system, and good management structure. Lo and Tang (1994) utilize, again, a case study framework of descriptive nature to explain the differential performance of institutional arrangements (governance and management structures) in controlling water pollution from different sources (industrial and domestic) by considering the case of Guangzhou Municipality, China. The main result is that since no one set of institutional arrangements can solve all types of

[8] The rating scheme involves subjective considerations in the sense of 'learned judgment'. Few instances for the rated variables are the level of government, stakeholder, and public support; economic, policy, and social contexts; and environmental stability.

collective problems, a better institutional performance can be ensured only by designing them to be compatible with the type of problems they confront.

There are also studies that specifically consider the role of the context within which the institution-performance interaction occurs in the water sector. For instance, Rausser and Zusman (1991) provides a theoretical model that considers the political, economic, and physical aspects of the water systems as parts of a co-evolutionary process. Although this study does not deal with either institution or its performance directly, it suggests a way for endogenizing the context of institution-performance interaction within the evaluation process itself. Similarly, utilizing the case of the River Platte in the north-west US, Yang (1997) describes the way water institution, resource system, and competing economic and social interests interact and co-evolve through time.

EVALUATION METHODOLOGY

The analytical framework outlined above provides a basis for developing a methodology for a quantitative evaluation both the institutional inter-linkages (see Figure 1) as well as the institution-performance linkages (see Figure 2). The methodology involves two inter-related steps. First, for the purpose of translating the analytical framework into an empirically applicable form, a set of variables is identified to capture various analytical components and aspects of both water institution and water sector performance. The selection of each of these variables is guided not only by its ability to reflect the status of a given component or aspect but also by its amenability for numerical translation within an empirical setting. Obviously, some of these variables are quantitative or, at least, quantifiable by proxies whereas others are inherently qualitative and, therefore, relative involving subjective or judgmental considerations. And, second, given the identified set of institutional and performance variables, various layers of institutional inter-linkages and institution-performance linkages evident in figures 1 and 2 are translated in the form of functional models which can be empirically estimated within a regression framework.

Definition of Variables

The definition of both the institutional and performance variables flows directly from the analytical decomposition of water institutions and water sector performance. Each of the decomposed institutional and performance aspects is captured by one or more variables depending upon the desired level of detail. To facilitate a better interpretation of these variables, it is necessary to describe their nature and format including the range of values they can take. The institutional and performance variables are defined below.

Water Law Variables

LTRWSA = Legal treatment of surface and subsurface sources, a dummy variable with 1 if both sources are treated alike but 0 otherwise;

LPRSRF = Format of surface water rights with a value range of 0-6 where 0 for no rights, 1 for unclear/unauthorized/scattered rights, 2 for common/ state property, 3 for riparian system, 4 for appropriative system, 5 for

correlative (proportional sharing) system, and 6 for licenses/permits;

LCRMEE = Effectiveness of conflict resolution mechanisms[9] captured in terms of judgmental perception and expressed on a 0-10 scale;

LACPRE = Overall effectiveness of accountability provisions[10] evaluated in terms of judgmental perception and expressed on a 0-10 scale;

LINTRE = Overall ability of water law to provide a legal framework for an integrated treatment of water from various sources evaluated in terms of judgmental perception and expressed on a scale of 0-10;

LOECEN = Extent of centralization tendency within water law evaluated in terms of judgmental perception and expressed on a scale of 0-10;

LOEPRV = Legal scope for private sector participation in water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

LOEFWL = Overall effectiveness of water law[11] evaluated in terms of judgmental perception and expressed on a scale of 0-10;

Water Policy Variables

PPSCRI = Project selection criteria having a value range of 0-6 with 0 for no response, 1 for political dictates, 2 for equity factors, 3 for ecological factors, 4 for benefit-cost ratio, 5 for internal rate of return, and 6 for multiple criteria;

PCOREC = Cost recovery status with 0 for non-response, 1 for full subsidy, 2 for partial recovery, and 3 for full-cost recovery;

PIRSWE = Smoothness of inter-regional and inter-sectoral water transfers evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PGPIPP = Impact of private sector promotion policy evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PGPIUP = Impact of the policy for promoting users' participation evaluated in terms of judgmental perception and expressed on a scale of 0-10;

POPAWE = Extent of the influence of other policies[12] on water policy evaluated in terms of judgmental perception and expressed on a scale of 0-10;

POELWL = Extent of linkages between water law and water policy evaluated in terms of judgmental perception and expressed on a scale of 0-10;

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[9] The conflict resolution mechanisms considered for evaluation include: bureaucratic systems, national water council and the like, tribunals, water court systems, judicial/legislative mechanisms, river boards, basin level organization and the like, WUAs, and multiple arrangements;

[10] The accountability provisions considered for evaluation include both those related to officials (e.g., indemnity clause, penalty provisions, and administrative actions as well as those related to users (e.g., injunctions, sanctions, and tortiuous liabilities).

[11] The key issues considered in the evaluation of the effectiveness of water law include: its current and future relevance, synergy with other laws, and capacity for conflict resolution as well as its ability to adjust with environmental issues and emerging technologies.

[12] These policies include agricultural policies, energy/power policies, fiscal policies, economic policies, credit/investment policies, environmental policies, trade policies, and foreign policy.

POEFWP = Overall effectiveness of water policy evaluated in terms of judgmental perception and expressed on a scale of 0-10;[13]

Water Administration Variables

AORGBA = Spatial organization of water administration taking a value of 0 for non-response, 1 if organized in terms of administrative divisions, 2 for the hybrid basis, i.e., in terms of both geographic divisions and hydro-geologic regions, 3 for broad hydro-geological regions, and 4 for river basins;

ABALFS = Balance in functional specialization, a dummy with 1 if balanced and 0 otherwise;

AIBDWP = Existence of an independent body for price determination/revision, a dummy with 1 for existence and 0 otherwise;

ASBUDC = Seriousness of budget constraint facing water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AACCME = Effectiveness of the accountability arrangements[14] evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AARINF = Adequacy/relevance of the information base evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AEXTST = Extent of science/technology application[15] in water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AOEFWA = Overall operational ability of water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

Performance Variables

WSPPHY = Physical performance[16] of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

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[13] The overall effectiveness of the water policy is obtained by averaging the judgmental values reported for the effectiveness of policies with respect to project selection, cost recovery, water pricing, regulatory and incentive aspects, water education and extension, application of water information, and management technologies.

[14] The accountability arrangements considered here include the following categories present both within and outside formal water administration: administrative oversight, financial auditing (Public Accounts Committees), work auditing, grievance cells, monitoring procedures for sectoral/regional water allocation, inter-ministerial committees, statutory bodies, local administration, user groups, and NGOs.

[15] The extent of science/technology application is evaluated by considering the use of computers, remote sensing and satellite, research/experimental information, modern accounting/auditing techniques, management information system, geographic information system, wireless communication, water measuring technologies, and computerized dynamic control of canal/water delivery networks.

[16] Physical performance of the water sector is evaluated by considering the following aspects: ability to bridge the overall demand-supply gap, physical health of water infrastructure, conflict resolution efficiency (low-cost and less time), and smoothness of water transfers across sectors/regions/users.

WSPFIN = Financial performance[17] of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;
WSPECO = Economic Performance of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;
WSPEQU = Equity Performance of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;
WSPOEV = Overall performance of water sector obtained by averaging WSPPHY, WSPFIN, WSPECO, and WSPEQU; and
WIPOEV = Progressiveness or the overall adaptive capacity of water institution taken as a whole evaluated in terms of judgmental perception and expressed on a scale of 0-10.

Although the variables as defined above are self-explanatory, few words are in order to recognize some of their general characteristics. Both the institutional and performance variables can be grouped into two broad categories, i.e., the factual and perceptional variables. The factual variables can be observed whereas the perceptional variables involving judgmental considerations cannot be observed. Even though the factual variables are observable, problems like uncertainty and incomplete information can lead to multiple answers. For instance, the legal format of water rights is subject to multiple interpretations notwithstanding a complete legal clarity in water law. In contrast, there are institutional and performance variables which specifically require judgmental considerations to have numerical information on them. Instances for these cases are the variables aiming to capture both the overall as well as component-wise performance of water institution.[18] As alluded already, value judgments are also unavoidable even in the case water sector performance in view of the need to circumvent data problems and to incorporate futuristic considerations into the evaluation process.

The variables can also be grouped into three categories based on the value they take, i.e., dummy (0 or 1) variables, categorical variables taking integer values within a given range, and scale variables taking a value in the 0-10 range. The first two groups of variables are essentially factual and involved only in the case of water institution whereas the variables in the third group are basically perceptional or judgmental in nature and involved in all cases where performance evaluation is needed. While the dummy variable indicates the existence or otherwise of a given institutional aspect, the categorical

[17] While financial performance is evaluated in terms of overall cost recovery and investment adequacy, the economic performance is evaluated with due considerations to both the gap between water charges and supply cost as well as the gap between water charge and the economic or scarcity value of water.

[18] This is not to deny the fact that some institutional aspects can be captured through observable and quantifiable variables. For instance, the effectiveness of the conflict resolution aspect of water law can be expressed in terms of the number of unresolved water conflicts. Similarly, the size of water administration can be expressed in terms of staff strength and the effectiveness of cost recovery policy can be captured by the gap between water rates and supply costs. But, apart from the usual information problems, the need for incorporating factors like futuristic considerations, qualitative dimension, and regional variations increases the value of subjective and judgmental information.

variable attempts to place a given institutional aspect into a fixed number of feasible categories.

In the case of categorical variables, the categories are identified either in terms of their actual occurrence or in terms of theoretical possibilities. For example, the categories identified for water rights are based on a modification and extension of the four-way classification of property rights made by Bromley (1989a:205) to the particular context of water resource. In the context of all categorical variables, the numerical value for each category is assigned consciously to obtain an ascending order in terms of their values. While there is some value judgement involved in the ordering of categories, the process does utilize both the available empirical evidence and acceptable theoretical justification. For example, the higher value for appropriative rights is based on its superior allocation efficiency over both the state/common property rights as well as the riparian/correlative rights (see Burness and Quirk, 1979; Hartman and Seastone, 1970; Saleth, Braden, and Eheart, 1991). On the other hand, the ordering of categories in cases like project selection criteria and cost recovery is based purely on economic reasoning. Finally, the bounded nature of the scale variables within the 0-10 range has important implications. Since zero means the worst situation and 10 means an ideal situation, the intermediate values taken by the scale variables can be interpreted as the extent the actual situation deviates from either the worst or the ideal situation. In this sense, the scale variables add a relativity dimension to evaluation of various institutional and performance aspects.

Models of Institution-Performance Linkages

Given the set of institutional and performance variables, it is rather straightforward to specify the models that characterize some of the policy-wise most important layers of the institution-performance interaction within water sector. In formal terms, the functional relationships that the performance of both water institution and water sector performace can be described by the following set of equations:

$$\text{LOEFWL} = f_1[\text{LTRWSA, LPRSRF, LCRMEE, LACMEE, LINTRE, LOECEN, LOEPRV}] \quad [1]$$

$$\text{POEFWP} = f_2[\text{PPSCRI, PCOREC, PIRSWE, PGPIPP, PGPIUP, POPAWE, POELWL}] \quad [2]$$

$$\text{AOEFWA} = f_3[\text{AORGBA, ABALFS, AIBDWP, ASBUDC, AACCME, AARINF, AEXTST}] \quad [3]$$

$$\text{WIPOEV} = f_4[\text{LOEFWL, POEFWP, AOEFWA}] \quad [4]$$

$$\text{WIPOEV} = f_5[\text{LTRWSA, LPRSRF, LCRMEE, LINTRE, LOECEN, LOEPRV, PPSCRI, PCOREC, POPAWE, POELWL, AORGBA, ABALFS, AIBDWP, ASBUDC, AACCME, AEXTST}] \quad [5]$$

$$WSPOEV = f_6[LOEFWL, POEFWP, AOEFWA] \quad \text{..... [6]}$$

$$WSPOEV = f_7[LTRWSA, LPRSRF, LCRMEE, LINTRE, LOECEN, LOEPRV, PPSCRI, PCOREC, POPAWE, POELWL, AORGBA, ABALFS, AIBDWP, ASBUDC, AACCME, AEXTST] \quad \text{..... [7]}$$

$$WSPOEV = f_8[WIPOEV] \quad \text{..... [8]}$$

Of these equations, the first three are central and crucial because of their structural linkages with other equations. Equation [1] postulates that the overall performance of water law is a function of seven water law aspects. These legal aspects are: the legal treatment of water sources, the format of rights in surface water use (considered as a proxy for the general format of water rights), the effectiveness of conflict resolution mechanism, the effectiveness of accountability provisions, the level of internal consistency within water law, the degree of centralization tendency within water law, and the legal scope for private sector participation. Similarly, equation [2] considers the overall performance of water policy as a function of seven water policy aspects. These policy aspects are: the project selection criteria, the cost recovery status, the effectiveness of inter-regional/sectoral water transfer policy, the extent of the impact of government policy towards private sector and user participation, the effects of other economic policies on water policy, and the extent of linkage between water law and water policy. Likewise, equation [3] specifies the overall performance of water administration as a function of seven administrative aspects. These administrative aspects are: the organizational basis of water administration, the level of balance in functional specialization, the existence of an independent body for water pricing, the severity of budget constraint, the effectiveness of administrative accountability, the adequacy/relevance of information, and the extent of science and technology application within water administration.

While the first three equations are designed to capture the functional linkages within each of the three water institution components, equations [4] and [6] show respectively how the performance of water institution and water sector are linked with both the individual and joint performance of the three water institution components. Also note that the dependent variables in the first three equations enter as independent variables in equations [4] and [6]. The implicit sequential relationship that equations [4] and [6] have with the first three equations is made more explicit in equations [5] and [7]. In these two equations, the respective performance of water institution and water sector is specified as an explicit function of some of the most crucial independent variables in the first three equations.[19]

[19] Although all the 21 independent variables in the first three equations can be included in equations [5] and [7], only 16 of them were included because of the small sample (i.e., 43 observations) and the consequent need to preserve the degree of freedom for the estimation process. Despite this fact, the structural relationship that these equations have with the first three equations is still strong and valid.

Finally, equation [8] that postulates water sector performance as a function of water institution performance tries to evaluate directly the performance linkage between water institution and water sector. Taken together, the eight equations--with different levels of detail and disaggregation--can help in evaluating some of the most important and policy-wise relevant layers in the institution-performance interaction. Thus, when these equations are estimated within an appropriate empirical context, the sign and size of their coefficients could provide valuable insights into the relative role that various institutional aspects play in determining the performance of both water institution as well as water sector.

EMPIRICAL CONTEXT

The review of existing literature on institutional evaluation shows how unique the present attempt is in its detailed modeling of the institution-performance interaction within the water sector. It also demonstrates how serious are the information challenges involved in the empirical translation of such an interaction process. It is true that the issue can be quantitatively addressed by using either time series data for a country or cross-section data for a large set of countries, or combining both the time-series and cross-section data. Unfortunately, the task of obtaining actually observed and also internationally comparable time-series or cross-section data sufficient enough for an empirical estimation of the models specified in equations [1] to [8], though not impossible, is extremely costly in terms of both time and resources. Even if such data is available, there is still a problem as they represent a past situation and cannot, therefore, capture expectation and futuristic trends. Since observed data can allow only an ex-post rather than an ex-ante analysis, their value for policy purposes is obviously limited.

Executive Perception as an Empirical Basis

To overcome the problems of both the non-availability and limitations of the observed data, the present study follows the empirical approach of using the executive perception-based data for institutional analysis (see Knack and Keefer, 1986; Cukierman, Web, and Neyapti, 1992; Gray and Kaufmann, 1998). Relying on this empirical approach, the information on all relevant institutional and performance variables is obtained by administering a structured questionnaire to a sample of key water sector experts from selected countries. Notably, the information, even on the variables capturing water sector performance, is also obtained within the judgmental framework for following two reasons. First, observed data, though available on some of the aspects of water sector performance, is neither adequate to cover all performance aspects nor capable of capturing the ongoing as well as prospective performance changes. As a result, the information on all performance variables can also be obtained within the framework of judgmental evaluation. And, second, in addition to its role in solving the data problems, this approach also provides a consistent data set where each set of independent institutional observations has its own set of corresponding observation on water sector performance.

Apart from its ability to overcome the constraint of observed data, the approach of using executive perception as an empirical basis also has a number of other advantages. First, it allows considerable freedom in the choice of institutional and performance variables and also enables the acquisition of all relevant information. Second, it can tap both the accumulated wisdom and futuristic considerations that are not captured by observed data. Third, not only can it synthesize different types of information (i.e., objective data, subjective observation, and expected trend) but also internalize some of the complicated and difficult-to-measure concepts (e.g., performance, efficiency, and equity). And, finally, given its empirical reliance on a cross-section of countries and experts, it can capture the effects of the variations not only in the exogenous factors (e.g., political system, demographic condition, economic development, and resource endowment) but also in the individual-specific subjective factors (e.g., disciplinary background, experience, and ideological orientation). With its empirical precedence and practical advantages apart, the use executive perception as an empirical basis for the evaluation of institution-performance interaction can also be justified in terms of some theoretical results from the institutional economics literature. Since institutions are not objective phenomenon but a human mental construct that think and act through the medium of individuals (Douglas, 1987; Stein, 1997), the approach of evaluating water institutions and their performance impact based on the perception of water sector experts remains theoretically consistent. Similarly, since the subjective nature of institutions makes value judgments unavoidable in their evaluation (Bhaskar, 1997:773), the subjective or judgmental evaluation of institutions is again justified.

Sample Selection and Characteristics

The value and credibility of the models of institution-performance interaction within a cross-country perspective depend obviously on the choice of the sample countries as well as the sample of experts identified from each of them. The sample countries are: Australia, Brazil, Chile, China, India, Israel, Mexico, South Africa, Spain, Sri Lanka, and the US (Illinois and Colorado). Importantly, these countries/regions taken together account for about 27 percent of the global area, 41 percent of global population, and 20 percent of global renewable water resources. Since the sample covers different continents, historical backgrounds, political systems, development stages, demographic trends, water law traditions, and, more importantly, levels of water scarcity, it can represent well the reality of global water sector in all its relevant dimensions. The representative character of the sample is enhanced further by the fact that it also covers the full spectrum of recently observed institutional changes in the global water sector both in terms of their coverage and effectiveness (see Saleth and Dinar, 1999).

The choice of the sample countries is purposive to ensure diversity of situations whereas the choice of the sample of experts *almost* random more by accident than by design. First, a total of 98 key water sector experts--with a diverse disciplinary orientation, wider experience, and international exposure--were identified from the sample countries. Considering this list of experts as a preliminary sample, an exhaustive but pre-tested questionnaire was either personally handed over or mailed to them. Only 50 percent of the 98 experts have responded with a completed questionnaire. Even

among these responses, only 43 turned out to be complete to give comparable information on all the variables and the rest could not be used in view of large gaps or partial responses. It is these 43 responses that form the information basis for the quantitative evaluation of the institution-performance interaction reported in this study. The descriptive statistics for the institutional and performance variables--tabulated by sample countries and disciplinary background of experts--are given in Appendix A.[20] The questionnaire used for the survey is reproduced in Appendix B. And definitions of all variables in the questionnaire in an alphabetical order are presented in Appendix D.

As to the composition of the sample, Figure 3 shows the country-wise distribution of the sample of international experts while Figure 4 depicts the disciplinary background of the final sample of experts. The number of respondents ranges from 6 for Mexico to 2 for South Africa with an overall average of 4 per country. The majority of the respondents are engineers (46 percent) and economists (40 percent). The rest are either lawyers or represent other disciplines such as hydro-geology, management, and sociology. This strict disciplinary characterization of experts does not, however, reflect fully their vast trans-disciplinary knowledge gained either through experience or through interaction. The fact that they were able to provide complete answers to all the issues covered in the exhaustive questionnaire used in this study (see Appendix C) is itself an ample testimony for their wider knowledge base that extends much beyond their strict disciplinary background.

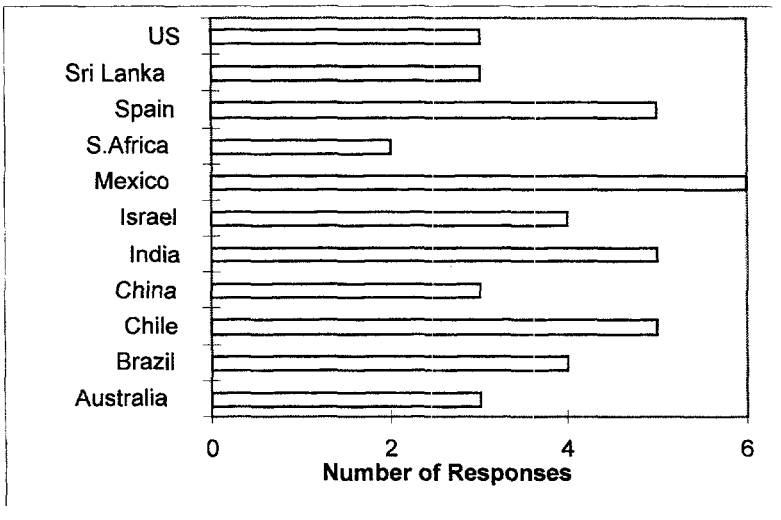

Figure 3
Regional Composition of the Sample of Experts

[20] Appendix-A provides the descriptive statistics for only 30 institutional and performance variables that are included in the present analysis. For the descriptive statistics and raw data for all 75 variables--17 legal variables, 25 policy variables, 27 administrative variables, five water sector performance variables, and one water institution performance variable--that can be generated from the questionnaire, see Appendix C.

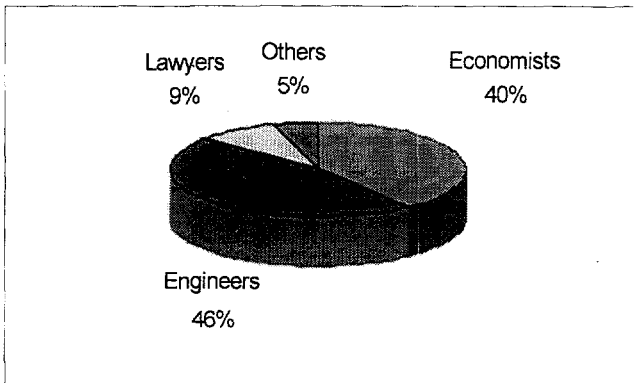

Figure 4
Disciplinary Background of the Sample of Experts

Another relevant aspect related to the sample composition is that it also covers experts from both the government and non-governmental spheres. While experts within government are officials at the highest echelon of water administration in the respective countries, others include retired officials, academicians, and international consultants. As noted already, since international exposure is one of the major criteria for their selection, the experts do have considerable knowledge on the water sector and its institutional arrangements in other countries. Overall, the sample displays a wider diversity not only in terms of the background and experience of experts but also in terms of the development status, political arrangements, and resource endowments of the countries. It can, therefore, provide a broader spectrum of both country-specific as well as cross-country perspectives on the linkages both within and between water institution and water sector performance.

Perceptional Information: Empirical Validity and Interpretation

The use of executive perception as an empirical basis for institutional analysis does have empirical precedence, theoretical justification, and practical advantages. While the empirical approach is certainly legitimate, there are still questions as to the nature of the perception-based information, its interpretation, and its amenability for a regression-based analysis. Since the validity of the results and the credibility of their policy implications are predicated ultimately on the appropriateness of the empirical context and the quality of the information, some of the most important among these questions have to be addressed prior to the analysis of the regression results.

Is the Perception-based Information Comparable?

The comparability of information is a precondition for its use in a regression context. The question over comparability arises from both the perceptional basis of the information and as well as the structure of the sample with different countries and different expert from the same country. Since water institutions and water sector issues differ both within and across countries, the responses of the experts are considered to reflect their subjective evaluation of different and apparently distinct institutional

arrangements and performance conditions. But, this argument for the non-comparability of the responses ignores both the basic conceptual framework as well as the quality of sample experts involved in the evaluation process.

Conceptually, water institution of each country can be considered as a set containing all of its legal, policy, and administrative features. For visual purpose, let this set be represented as a circle. Although water institutions differ across countries, they do share certain common features. To reflect this reality, the water institutional arrangements at the global level can be represented by a larger circle that contains the set of intersecting circles representing both country-specific as well as common institutional aspects. A similar analogy can also be extended to conceptualize the water sector at the global level. Given their international experience, it is reasonable to consider that they evaluate only these larger sets--representing respectively the institutional arrangements and performance levels of the global water sector--that are being evaluated by them. Since the experts evaluate their country-specific situation with reference to global situation, their observations pertain to different parts of the larger entities of global water institution and global water sector. On this logic, it is legitimate to consider the independent observations of the sample experts as comparable.

While the conceptual basis of evaluation ensures the general comparability of information, a few additional aspects of comparability are to be noted in the context of both factual and judgmental information. For instance, the factual information on an institutional feature provided by an expert from a given country becomes also relevant and comparable with that provided by experts from other countries with a similar institutional feature. The judgmental information obtained on a 0-10 scale implies that the values reported by experts are an outcome of a comparison of the current situation with an ideal situation that lies at the back of their mind. Such information can be compared only when the 'ideal situation' is the same (or, at least, closer) across experts. Since the ideal situation can either be the one existing in some other countries or be the one existing in theory, it is likely to be same across experts having substantial international experience and subject knowledge.[21]

Does Institutional Diversity Inhibit the Evaluation?

Although the present study aims to evaluate the effects of institutional variations on the performance of both water institution and water sector performance, such an evaluation is in terms of variations that are observed in major institutional typologies rather than in micro level details. Thus, the micro level institutional details--certainly an important concern for studies associated with the institutional diversity at national and regional

[21] Even if the ideal situation is not exactly the same, the independently reported judgmental values can be shown to be comparable--both within and across countries--in the sense as consumption expenditure or poverty level is being compared across individuals and countries with different utility for money and living standard norms. Again, from another perspective, the values are conceptually not much different from the one obtained from willingness-to-pay or contingent valuation surveys among individuals with different socio-economic background and other subjective characteristics.

level, are not pertinent for the main purpose of this study. This can be illustrated by considering the legal format of water rights. While the format of water rights displays wider variations across countries, regions, and water sources, it is still possible to identify a generic set of key typologies of water rights format such as the common property rights, riparian rights, appropriative rights, correlative rights, and water permits. Since this study requires only the evaluation of the relative effects of these broad categories rather than their micro level variants, the evaluation is not constrained by the micro level institutional diversity.

How to Interpret the Variations in Experts' Responses?

When water institutions are effective in the sense that they are powerful enough to pervade the minds of the decision-makers and influence, thereby, their water allocation and use decisions, the variations in the responses of experts are likely to be lower. Otherwise, the variations will be wider among the responses due to the role of disciplinary background, differential interpretation, and other subjective factors. If the subjective factors are powerful enough to disorient perception, then, water institutions have failed in their basic role of providing a transparent framework for human-water interaction. Intuitively speaking, the magnitude of these variations can be considered as a measure of institutional ineffectiveness. For instance, the variations in factual information (e.g., the format of water rights or conflict resolution mechanism) among experts from the same country represent the degree of ignorance or uncertainty which can, in fact, be considered more as a measure of institutional ineffectiveness than as a limitation of sample experts.

Similarly, since the variations in the judgmental information of experts from the same country will be larger when institutions are ineffective and subjective factors like bias and expectations are dominant, the magnitude of such variations can also be considered as a measure of institutional ineffectiveness. While inter-country variations in both kinds of information can be considered as an indication of cross-country variations in performance of both water institutions and water sector, their intra-country variations can be interpreted as an indicator of the level of uncertainty over the features of water institutions and their performance impacts. Since the main function of institutions is to reduce uncertainty and increase transparency, the extent of uncertainty or ambiguity evaluated in this manner can also provide comparative insights on the relative efficacy and performance of water institutions in different contexts.

Can the Perception-based Data be used in a Regression Context?

The comparability of information, though necessary, is not sufficient to justify its use within a regression framework. The sufficient condition for the use of perception-based information in a regression context, however, comes from the following observation that forms the very foundation of the evaluation methodology outlined above. Experts are often observed to say that the water sector performance of a given country/region is low because of poor institutional arrangements. This is not a casual statement but based on a mental process of evaluation that compresses both the observed data as well as subjective

information on water institution and water sector performance.

It is reasonable, therefore to magnify and elaborate the mental process of evaluation to ask how low is water sector performance and how poor are the water institutions and use such information to see the linkages between water institutions and water sector performance. This is exactly what the evaluation methodology of this study does to obtain all the relevant information from a sample of international experts and the regression models specified in equations [1] to [8] does to evaluate the linkages between water institution with water sector performance. Since the regression exercise actually mimics the process of evaluation that occurs in the minds of experts relying on the same set of information used in such a process, the use of the perception-based information within a regression framework is intuitively consistent and justified.

Do the Regression Results Reflect Only the Expected Linkages?

While the responses of experts is an outcome of not only their observations of reality but also their expectations of desirable situation, the regression results cannot be considered to reflect only the expected linkages. As long as the responses are truthful and are based on observed information, the results do reflect the actual linkages. Given the fact that the sample covers internationally known experts with a considerable stake on their reputation when revealing their knowledge and judgment, it is unreasonable either to question the integrity and objectivity of their responses or to consider the evaluation as a hypothetical exercise for making self-fulfilling prophecy. Even when the regression results reflect only the expected linkages, they are still valid because they are not used here to prove the already known fact that institutions matters but to evaluate the relative impact of institutional aspects on the performance of water institutions and water sector performance. In this sense, the regression results can be considered as a means for finding an international consensus in the relative importance of various institutional components and aspects in addressing water sector problems.

Can the Presence of an Institutional Aspect Ensure Better Performance?

Some of the equations in the model of institution-performance interaction postulate that the presence of an institutional aspect can improve performance on the reasoning that the performance of both water institution and water sector is likely to be better than otherwise. This does not mean any mixing up of 'cause' and 'effect'. Since there are sequential linkages and synergy among institutional components, institutional components that are considered as a means to induce changes in the institutional and water sector spheres are themselves an outcome of prior changes in other institutional components. Considering water rights system as an example, the presence of such a system implies also the presence of a related set of legal, policy, and administrative arrangements that are necessary to support its operation. While water rights system is certainly a means for improving water sector performance, it is also an end from the viewpoint of institution building. Similarly, financial self-sufficiency or cost recovery, which is an end from the financial angle, is also a means for improving the physical

health and operational efficiency of water projects. Thus, the cause-effect categorization is path dependent in the sense that a 'cause' can be an 'effect' and vice versa depending upon the objective with which the evaluation proceeds.

RESULTS AND ANALYSIS

Prior to the presentation and analysis of the results, it is useful to understand some of the empirical features of the model of institution-performance interaction specified in equations [1] to [8]. First, although it is possible to use different functional forms like log-log and log-linear, only simple linear forms are used here for the empirical estimation of all equations. Second, although equations [1] to [8] are specified as independent of each other, there is a strong sequential, or even, simultaneous relationship between some of them. While this points to the need for estimating these equations within a system framework, the lower degree of freedom associated with the smallness of the sample prevents the system-based regression estimation at this stage. Consequently, the equations are estimated using the Ordinary Least Squares (OLS) technique. And, finally, all the equations are estimated with a constant term with the express purpose of capturing the important effects that the context as defined by exogenous factors (i.e., socio-economic, political, demographic, and ecological factors) has on the process of institution-performance interaction within water sector.

Since the model equations capture different layers of the institution-performance interaction, the analysis of their results can be more illuminating when the evaluation proceeds in a structured way. That is, each of the layers are evaluated first and utilizing such a disaggregated analysis, then, each of the two main dimensions of the institution-performance interaction, i.e., institutional inter-linkages and institution-performance linkages, will be evaluated. The institutional inter-linkages are evaluated at three levels. The first level evaluation deals with the relationship that the performance of each of the three components of water institution has with its institutional aspects (equations [1] to [3]). The second level evaluation considers the relationship that the performance of water institution has with the performance of its three components (equation [4]). The third level evaluation shows the relationship that the performance of water institution has with some of the major legal, policy, and administrative aspects (equation [5]).

The institution-performance linkages are also evaluated at three levels. The first level evaluation deals with the relationship that water sector performance has with the performance levels of the three water institution components (equation [6]). The second level evaluation shows the relationship that water sector performance has with some of the major legal, policy, and administrative aspects (equation [7]). The third level evaluation considers the relationship between water sector performance and water institution performance. Understandably, the nature and strength of these relationships are evaluated in terms of the size, direction, and statistical significance of the estimated coefficients of the variables included in each of the equations. In this way, the two main dimensions of the process of institution-performance interaction within water sector are evaluated from different angles with a view to identify the relative role of some of the

most important legal, policy, and administrative aspects underlying the performance of both water institution and water sector.

Institutional Inter-linkages

The regression results for equations [1] to [3] show how the effectiveness or performance of each of the three components of water institution, i.e., water law, water policy, and water administration, is influenced by the nature and status of its constituent institutional aspects. On the other hand, the results for equations [4] and [5] show respectively how the overall performance of water institution depends on the performance of its three components and some of their underlying institutional aspects. The regression results for these five equations can, therefore, be used to highlight some of the major features of the institutional inter-linkages evident within each of the three components of water institution.

Water Law Performance: Relative Role of Legal Aspects

Table 1 presents the regression result for equation [1] that postulates water law performance as a function of some of the major water law aspects. Considering the R^2 and F-value for the estimation, the model is reasonably sound in terms of its explanatory power. All variables except the one capturing the centralization tendency in water law have a positive effect on water law performance. The constant term that captures the effects of the general environment as defined by exogenous factors also has a positive sign indicating its overall favorable role. While the signs of all the variables are consistent with expectation, the statistical significance of their coefficients (as evaluated in terms of their t-ratios and significance levels) indicates that the variables differ in terms of their importance for the performance of water law.

Of the seven legal variables considered, only four are statistically significant in contributing to the performance of water law. These four variables capture respectively the following four legal aspects, i.e., integrated treatment of water sources, effectiveness of conflict resolution provisions, degree of integration within water law, and legal scope for private sector participation. Going by the relative size of the coefficients of these four statistically significant legal aspects, the one having a dominant influence on water law performance is the effectiveness of conflict resolution provisions. Next in importance are the degree of legal integration within of water law followed by the integrated treatment of water resources within water law. Among the remaining variables which are not significant at conventional level of significance (i.e., 10 percent), the format of surface water rights--included as a proxy for water rights in general--is relatively more significant than the rest of the non-significant variables.

Water Policy Performance: Relative Role of Policy Aspects

The relative effect of policy aspects on the performance of water policy can be seen from Table 2 that presents the regression results for equation [2]. Again, both the R^2 and F-value suggest that the independent variables included in the equation explain most of the variations in the dependent variable, i.e., the performance of water policy. Of the seven

policy variables considered, only four are statistically significant, suggesting the relative importance of the policy aspects represented by them in explaining the performance of water policy. These policy aspects--given in the order of their importance to water policy performance--are: cost recovery status, strength of law-policy linkage, project selection criteria, and extent of the influence of other policies (e.g., agricultural policy, fiscal policy, and trade policy) on water policy. Among these four aspects, the law-policy linkage and policy linkages between water policy and other policies are notable because they demonstrate the important role that institutional and policy inter-linkages play in improving the performance of water policy.

Considering the sign of the coefficients of the variables representing these four policy aspects, all of them except the variable capturing project selection have a positive influence on the performance of water policy. The unexpected sign of some of the policy variables included in equation [2] has an interesting interpretation. For instance, although the negative effect of the three policy aspects, i.e., project selection criteria, and effectiveness of policy with respect to private sector participation and user involvement, seems to contradict expectation, it can, however, be shown to be intuitively consistent. This is in view of the two-way flow of effects between water policy and its constituent policy aspects. Thus, instead of viewing that a better performance of these three policy aspects as causing a negative influence on water policy performance, it is equally legitimate to view that it is the poor performance of past water policy that leads to a better performance of these policy aspects. For instance, it is the failure of past water policies that has prompted current policy efforts to enhance the participation of private sector and users in project financing, maintenance, and management. Viewed in this sense, the negative coefficients of the three policy aspects are, in fact, an indication for the positive role that economically oriented project selection criteria and successful user and private sector participation can play in improving the future performance of water policy.

Water Administration Performance: Relative Role of Administrative Aspects

Table 3 presents the results for equation [3] that relates the performance of water administration with some of its key aspects. Unlike equations [1] and [2], equation [3] has a lower R^2 indicating a limited explanatory power of its independent variables. However, the statistical significant F-value suggests that the underlying model does fit the data well. Although all the seven variables have the expected sign, only two variables are statistically significant, that too, at somewhat a relaxed level of significance. Both of them are dummy variables capturing respectively the balance in functional specialization within water administration and the existence of an independent body for water pricing.

Interestingly, when equation [3] is estimated without the constant term, these two variables become insignificant but other variables like the severity of budget constraint, information adequacy, and the extent of science and technology application within water administration become significant. This means that the constant term--that is supposed to capture the effects of the exogenous factors representing the general socio-economic and political environment and resource endowment--also captures both the individual and joint effects of some of endogenous factors. Besides, given the intricate linkages among

various administrative aspects, the effects of some variables may get either captured by or mixed with others. Such a possibility indicates, in fact, the practical difficulties in isolating the effects of some of the individual law, policy, and administration-related institutional aspects even when water institution is decomposed with still finer analytical details. This applies especially to water administration where not only a clearer analytical decomposition is difficult but also the effects of most of the administrative aspects are too intertwined to isolate. Despite all these difficulties, the regression results could clearly identify the important role that functional balance and an administratively independent water pricing mechanism--the two aspects receiving top priority in the ongoing debate on water institution reform--play in explaining the performance of water administration.

Water Institution Performance: Relative Role of Institutional Components

The focus till now has been on the institutional inter-linkages within each of three components of water institution. Since these component level institutional inter-linkages, when taken together, pervade throughout water institution and acquire considerable synergy from the mutuality of their individual and collective effects, they have far reaching implications not just for the overall performance of water institution but also for its ultimate impact on water sector performance. It is, therefore, necessary to bring these component level institutional inter-linkages together to evaluate their impact on the overall performance of water institution. Such an evaluation is done sequentially by first relating the performance of water institution with the performance of its components and then by relating the same with some of the major legal, policy, and administrative aspects. The regression results for equation [4], which evaluates the relationship between the performance levels of water institution and its components, are given in Table 4.

For a proper interpretation of the results reported in Table 4, it is useful to recognize the fact that equation [4] is actually a sort of reduced form of equations [1] to [3] in that the dependent variables in these three equations enter as independent variables in equation [4]. Such a structural relationship reflecting the empirically important econometric linkages among these equations[22] can be utilized to evaluate the linkages among various layers of the institution-performance interaction. These econometric linkages are also important for the interpretation of results because of their role in explaining why variables capturing different institutional aspects that are significant in one context becomes not so in other contexts.

Returning to Table 4, although R^2 is low, all the variables have the expected positive effect suggesting that a better performance of each of the water institution components is likely to improve the overall performance of water institution. While this result appears to be tautological in nature, its real significance lies in demonstrating how the three institutional components differ in terms of their relative contribution to the overall performance of water institution. As can be seen, among the three variables, only the variable representing water policy performance is significant at 10 percent level and

[22] As will be shown subsequently, a similar relationship also exists among equations [1], [2], [3], and [6]. Here, the relationship captures the ultimate linkages that water institution and its components have with water sector performance.

the variable representing water administration performance is significant only at a relaxed level of significance. Although the variable representing water law performance is in significant, the constant term is highly significant suggesting the important role that the general environment--as defined by socio-economic, political, legal, and resource-related factors--plays in cementing institutional inter-linkages within water institution.

The insignificance of the variables capturing respectively the performance of water law and water administration can be due to the fact that their effects are captured by the constant term to the extent that the enforcement and implementation aspects are a function of political will and resource-related imperatives. One way of interpreting the dominant effect of water policy performance on the overall performance water institution is in terms of its pivotal position of simultaneously being both the political translation of water law as well as the operational framework for the functioning of water administration. Another interpretation emerges from a political economy perspective of the recent institutional changes observed especially among the sample countries. Since these changes confine mostly to the politically easier policy sphere rather than the politically risky and administratively difficult legal and administrative spheres (see Saleth and Dinar, 1999), the variable capturing water policy performance can become a dominant factor explaining the overall performance of water institution.

Water Institution Performance: Relative Role of Institutional Aspects

While the results for equation [4] reported in Table 4 shows the overall linkages between water institution and its constituent components, those for equation [5] reported in Table 5 show the linkages between water institution and some of the major institutional aspects underlying the three water institution components. These two equations are, therefore, interrelated not only because they have the same dependent variable but also because their independent variables are structurally related through equations [1] to [3]. Thus, equation [4], which is a reduced form of the first three equations, is brought to its full form in equation [5] by explicitly incorporating 16 most important independent variables included in the first three equations. The recognition of this fact is necessary for a better interpretation of the results reported in Table 5.

The results in Table 5 show how some of the most important legal, policy, and administrative aspects affect the overall performance of water institution. The model behind the results fits the data well and also has a good explanatory power. But, it shows that a number of variables--especially those related to legal and administrative aspects--have the unexpected signs. Even though these variables with the unexpected negative sign are not statistically significant, their perverse behavior requires, however, an explanation.[23] One explanation for this behavior lies in the differential performance of institutional aspects when they are combined with others. Thus, for instance, efficient conflict resolution provisions and functional integration within water law that had a significant positive effect on water law performance can be insignificant or have a

[23] Such an explanation is particularly necessary in the context of some variables (e.g., two legal aspects, i.e., the effectiveness of conflict resolution provisions and the legal integration within water law) that are shown to have a significantly positive effect on the performance of water institution components.

negative influence on the overall performance of water institution when they are combined with inefficient policy or administrative aspects. A similar argument can also be extended to show why only a very few variables are statistically signi cant in explaining the overall performance of water institution.

In terms of the statistical significance of the 16 variables included in the model, only four variables--representing each one of the legal and policy aspects and two administrative aspects--are significant either at the conventional or at a relaxed level of significance. Notably, all these statistically significant institutional aspects have a positive effect on water institution performance. These institutional aspects are: the linkages between water policy and other economic policies, balance in functional specialization, the existence of an independent body for water pricing, and the legal scope for private sector participation. In terms of their relative impact on water institution performance as indicated by the size of their coefficient and T-ratio, the first two institutional aspects noted above are more important than the other two. In any case, the significant positive effect of these four institutional aspects clearly suggest the dominant role that capacity building, policy inter-linkages, and financial health play in improving the overall performance of water institution.

Institution-Performance Linkages

The focus of the analysis, so far was on the first dimension of the institution-performance interaction within water sector, i.e., the institutional inter-linkages. The analysis shifts now to the other dimension of the interaction, i.e., the institution-performance linkages. The institution-performance linkages are evaluated using the three equations [6] to [8]. While equation [6] captures the linkages between water sector performance and the performance of three components of water institution, equation 7 captures the same linkages between water sector performance and some of the major institutional aspects underlying these water institution components. Equation [8], on the other hand, captures the overall performance linkages between water institution and water sector. Since these equations evaluate the linkages between water institution and water sector performance at different levels of institutional disaggregation, the regression pertaining to these three equations can be used to evaluate some of the main layers of the institution-performance linkages possible within water sector.

Water Sector Performance: Relative Role of Institutional Components

The relative role that the three water institution components play in explaining water sector performance can be seen from Table 6 that presents the regression results for equation [6]. All three variables representing respectively the performance of the three water institution components, law, policy and administration, have a positive sign, suggesting their favorable role in improving water sector performance. But, among these three variables, only the variable representing water law performance is statistically significant and also contributes the most in explaining water sector performance. The variable representing water policy performance becomes significant only at a somewhat relaxed level of significance whereas the other representing water administration

performance is not at all significant in explaining water sector performance.[24] This result suggesting the relative dominance of water law performance does not mean that the performance levels of the other two components of water institution are unimportant in explaining water sector performance. This is because of the significance one institutional component encompasses, not just from the strength of that component alone but equally also from the interactive roles of other components as well as the role of the general environment within which the institution-performance interaction occurs.

Speaking of the role of the general environment, the constant term that captures the joint effects of the factors exogenous to water sector has a statistically significant positive effect and such effect is stronger even as compared with that of the dominant endogenous factor, i.e., water law performance. This can imply either the powerful intervening effects of exogenous factors on the process of institution-performance interaction or the capacity of the constant term to capture some of the effects of the other non-significant endogenous factors. Whatever are the reasons for the positive and significant effects of the constant term, it does suggest that the general environment is becoming increasingly favorable and has considerable synergy to produce a snowballing effect on the performance implications of institutional changes in the water sector. This means that the ultimate effects of institutional change on water sector performance are going to be far greater than the intermediary effects of the same on the performance of either water institution or its components.

Water Sector Performance: Relative Role of Institutional Aspects

Unlike Table 6 that relates water sector performance to institutional aspects indirectly through the performance of water institution components, Table 7 relates the same to institutional aspects directly. Since the results in Table 7 allow a more direct evaluation of the relative effects of institutional aspects on water sector performance, they shed lights on the most important layer of the institution-performance linkages within water sector. In terms of the R^2 and F-value, the model behind the results in Table 7 explains about two-thirds of the variations in the dependent variable and also fits the data well. Despite these desirable econometric features, the results show that only three of the 16 institutional aspects considered for evaluation are statistically significant and all the three have a positive effect on water sector performance. These institutional aspects--given in the order of their relative importance--are: the integrated legal treatment of water sources, the existence of an independent body for water pricing, and the balance in functional specialization. While the first aspect forms the legal basis for the promotion of integrated water resource development accepted widely as a key strategy for sustainable

[24] It can be recalled that these three variables have differential effects on water institution performance. While the variable representing water administration performance remains insignificant in explaining the performances of both water institution and water sector, water law performance that had an insignificant effect on water institution performance has significant effect on water sector performance. In contrast, water policy performance that had a dominant effect on water institution performance has only an insignificant effect on water sector performance.

water management, the others are important either for capacity building or for improving financial sustainability within water sector.

As the level of significance is relaxed to about 20 percent, three more institutional aspects become significant. They are: the legal scope for private sector participation, policy inter-linkages between water policy and other policies like agricultural, fiscal, and trade policies, and the severity of budget constraint. While the first two have a positive effect suggesting the favorable roles that private sector participation and policy inter-linkages can play in enhancing water sector performance, the last one related to budget constraint has a negative effect. Budget constraint, if it is at a reasonable level, can have a healthy effect on water sector performance both by inducing efficiency in the allocation and utilization of limited financial resources as well as by providing an urge to search for internal avenues for revenue augmentation and cost minimization. But, when budget constraint is too severe, it can hurt water sector performance both directly by limiting development and maintenance investments within water sector as well as indirectly by limiting funds for capacity building within water institution. As to the role of policy inter-linkages, a water policy that is tailored to the overall policy framework is likely to improve water sector performance more than the one that is divorced from the general policy environment.[25]

Water Institutions and Water Sector: Overall Performance Linkages

After having evaluated the institution-performance linkages at different disaggregated levels, attention can now be directed at the nature of such interaction at the aggregate level by directly relating water sector performance with water institution performance. The results for equation [8] that makes such an attempt are presented in Table 8. The results confirm rather strongly that water institution performance has a statistically significant positive effect on water sector performance. As in the case of most other layers of the institution-performance interaction, the constant term is also significant and has a positive effect suggesting clearly the intrinsic synergy that such an interaction can derive from the general environment with a strong pro-reform orientation at present.

As a matter of fact, considering the relative size of the coefficients, the constant terms capturing the general environment has a much stronger effect on water sector performance as compared with the variable capturing the overall performance of water institution. This is understandable in view of the positive role of many developments that occur both within and outside the water sector. The worldwide resurgence of democratic form of government increases the scope for the adoption of decentralized and participatory systems in all spheres including water resource management. Economically and socially maturing social systems have enabled the emergence of new forms of social

[25] A relatively better water sector performance in Mexico and China, among others, demonstrates the value of water policy that is being conditioned by macro-economic policies. However, there are also contrary cases for the negative performance of water policy because of its being a hostage to other policies like agricultural policies. In this case, to achieve the targets of agricultural polices, the water policy aspects like water pricing and project selection are deliberately biased. Countries like India and Sri Lanka provide instances for the latter case.

organizations conducive for grassroots level allocation and management decisions. The widespread occurrence of water scarcity has enhanced both the relevance and prospects of many unconventional solutions (e.g., water markets) that were once considered infeasible. Scientific advancement and technical progress have created new possibilities for more accurate measurement and monitoring of resources including water. Since these developments tend to create a pro-reform climate, their synergetic impulses can be exploited through a proper design, sequencing, and timing of the strategy for institutional reforms within the water sector.

Despite the limitation of having a small sample and the difficulty in isolating the individual institutional aspects in the face of their intricate linkages, the models of institution-performance interaction is still on target as they identify some of the institutional aspects dominating the current debate on water institutional reform. Even though the estimated results for some equations indicate only a few institutional aspects as statistically significant, considering the sample limitations and looking at the institutional aspects identified by then as significant, the evaluation methodology underlying the estimation procedure can still be considered as robust. The regression analysis has also succeeded in empirically demonstrating three key issues having immense value not only for institutional design but also for its sequential implementation. These issues are: the relative importance of institutional aspects, the performance impact of their linkages, and the synergy possible from factors exogenous to water sector. The relative importance of institutional aspects as indicated by the size and significance of their coefficients is useful for institutional choice and design. Since the regression equations are estimated separately rather than as a system, the issue of institutional linkages could not be fully evaluated. The overall synergy possible from the general environment as defined by exogenous factors suggests the importance timing in institutional initiatives. Since the exogenous factors have an overall positive effect, the total transaction costs could be reduced not only by institutional sequencing but also by proper timing.

IMPLICATIONS FOR THEORY AND POLICY

The major thrust of institutional reforms within water sector is to enhance the functional capabilities, operational strength, and institutional readiness to handle water challenges both at present and in the future. Given this thrust, the main objectives of institutional initiatives are rather transparent. These objectives are to: make water as an economic good, strengthen allocation capabilities, increase the reliance on market forces, revive the payment culture, ensure financial self-sufficiency, promote decentralized decision structure, and encourage the adoption of modern technology and information inputs. While the economic and resource-related rationale for both the thrust and objectives of institutional change are well known, there is a lamentable dearth of understanding on the issue of how to effect water institutional change within the political economy constraints as well as opportunities.

In an attempt to bridge this knowledge gap, this study develops an analytical framework to identify various layers of institutional inter-linkages and institution-performance linkages evident in the process of institution-performance interaction within water sector and evaluates these layers of linkages using an evaluation methodology based on perception-based cross-country data. Both these analytical and empirical analyses are then used to identify key inputs for developing a generic strategy for water institutional reform that can minimize the transaction cost but maximize the performance impact.

Analytical and Methodological Contributions

This study has some unique analytical and methodological contributions to make in the context of institutional economics in general and water institution in particular. These are as follows:

First, this study, for the first time, makes an analytical decomposition of both the water institution and water sector performance. Briefly, water institution is decomposed into three broad components, i.e., water law, water policy, and water administration. Each of these institutional components is again decomposed to identify some of its major institutional aspects. Similarly, water sector performance--considered to cover the performance of all water sub-sectors--is also decomposed in terms of its physical, financial, economic, and equity dimensions. Utilizing this decomposition exercise, the institution-performance interaction within the water sector is elaborated to analytically demonstrate some of the major layers of institutional inter-linkages and institution-performance linkages.

Second, defining a set of variables to capture the institutional and performance aspects, some of the major layers of institutional inter-linkages and institution-performance linkages are formally modeled as a set of inter-linked equations. The constant terms in these equations are considered to capture the combined effects of the general environment facing the process of institution-performance interaction within water sector. Since the general environment is defined in terms of socio-economic, political, legal, and environmental factors that are outside the strict confines of water sector, it captures the intervening effects of factors exogenous to the water sector. In this way, the equations capture the effects of both the endogenous as well as exogenous factors.

And, finally, for the empirical estimation of the equations, this study relies on an evaluation methodology based on a cross-country survey of 43 water sector experts having different disciplinary background and professional orientation from 11 countries with diverse water problems, socio-economic settings, historical traditions, and political arrangements. While this methodology is nothing new, the justification for its legitimacy provided in this study is, however, new. Unlike the past studies, this study justifies this approach not so much in terms of data difficulties but in terms the subjective nature of institutions recognized repeatedly in the institutional economic literature. That is, institutions are inherently subjective in nature because they are human creations for increasing transparency and reducing uncertainty in human interactions and hence, they

exist, evolve, and interact with human beings. This fact justifies the use of executive perception as a legitimate basis for institutional evaluation.

Contribution of the Empirical Results

Both to demonstrate the robustness of the evaluation methodology as well as to facilitate the better interpretation of the policy implications of this study, it is useful to provide here the gist of the regression results. Since the empirical evaluation focuses on various layers of the institutional inter-linkages and institution-performance linkages evident in the process of institution-performance interaction within water sector, the results are organized following the same structure.

First, as to the institutional inter-linkages within each of the three water institution components, the results could identify some of the legal, policy, and administrative aspects that dominate the current debate on water institutional reform. As per the results, among the seven legal aspects considered for evaluation, only four are important in determining the performance of water law. These legal aspects are: the effectiveness of conflict resolution provisions, the degree of internal consistency within water law, the integrated treatment of water sources, and the scope for private sector participation. Even among these four legal aspects, the first two have a relatively stronger effect on water law performance as compared with others. Among the seven policy aspects considered, only four are significant in deciding water policy performance. These policy aspects are: the degree of economic orientation of project selection criteria, the level of cost recovery, the linkage between water policy and other policies (e.g., agricultural, fiscal, and trade policies), and the overall linkage between water law and water policy. In terms of relative importance, cost recovery comes first followed then by law-policy linkage and policy inter-linkages. Among the seven administrative aspects considered, only two aspects, i.e., the balance in functional specialization and the existence of an independent body for water pricing, have a dominant role in determining the overall performance of water administration.

Second, the institutional inter-linkages within water institution are evaluated by relating the overall performance of water institution first with the performance of its three constituent components and then with some of the selected institutional aspects from each of these three water institution components. The results for the first case show that the overall performance of water institution depends more on the performance of its policy and administrative components than on the performance of its legal component. The results for the second case show that of the 16 institutional aspects considered for evaluation, only four become significant in explaining water institution performance. These institutional aspects given in the order of their relative importance are: the degree of balance in functional specialization, the existence of an independent body for water pricing, the linkages between water policy and other policies, and the legal scope for private sector participation.

And, finally, the institution-performance linkages are evaluated by relating water sector performance first with the performance of the three water institution components and then with the 16 institutional aspects underlying the performance of these three water

institution components. The results, in the first case, show that water sector performance is linked more to the performance of water law and water policy than to water administration. The results, in the second case, identify the following institutional aspects to be major determinants of water sector performance. These institutional aspects given in the order of their importance are: the integrated legal treatment of water sources, the existence of an independent body for water pricing, the balance in functional specialization, the legal scope for private participation, and the seriousness of budget constraint. More importantly, the results in almost all cases also show that the constant term capturing the effects of the general environment as defined by the exogenous factors is not only significant but also positive. Now, some of the major policy implications emanating from the empirical analysis can be noted.

Policy Contributions

As to the policy contributions of this study, its analytical framework is itself important for the purpose of developing strategies for institutional reform within the water sector strategies. Since the analytical decomposition of both water institution and water sector performance provides a sound framework for understanding of the inner dynamics of the process of institution-performance interaction within water sector, it proves to be the starting point for framing institutional initiatives in the water sector. Although the analytical framework developed here is more generic and useful for planning institutional reform from an international perspective, country level planning, however, requires its specialization to country-specific contexts to take stock of regional variations and unique situations. In addition to the policy implications of the analytical approach, the regression results also provide key inputs for the strategy of institutional reform in the water sector. The policy contributions of the empirical results are as follows:

First, since the estimated coefficients of the equations indicate the relative strength, direction, and significance of the performance impact of institutional components and institutional aspects, they can be used as basis for identifying some of the most desirable features of a performance-oriented water institution. In general terms, an ideal water institution needs to have a water law that treats all water sources within an integrated framework, has effective conflict resolution provisions, reveals higher degree of internal consistency, and provides scope for private sector participation. Similarly, it is desirable to have a water policy centered on economically rooted project selection criteria, full cost recovery, stronger ties with other economic policies, and closer links with water law. Likewise, the most desirable features of water administration are the balance in functional specialization and the existence of an independent body for water pricing. These features set the priorities for institutional reform in a generic context.

Second, the institutional aspects identified to be the dominant features of an ideal water institution do not, however, imply that other institutional aspects are unimportant. In view of the intricate linkages among institutional aspects and the resultant difficulty in isolating the individual effects of various legal, policy, and administrative aspects, it is entirely possible that the effects of some aspects may be either picked up by or mixed up with those of the others. In the first case, the significant institutional aspects actually

capture also the joint effects of a set of other related institutional aspects. However, in the second case, institutional aspects, which are significant at an individual level, can become insignificant in a collective context where they are combined with other ineffective institutional aspects. From a policy perspective, therefore, it is necessary to recognize the institutional and performance linkages that the identified set of desirable institutional features has with others.

Third, although all water institution components and its constituent institutional aspects are interrelated and hence, equally important, the observed variations in the size and significance of their estimated coefficients in different evaluation contexts clearly suggest that they differ in terms of their institutional linkages and performance impacts. Since their differential effects reflect essentially the role of both time lag and operational proximity, it is reasonable to order and sequence the institutional aspects in terms of their instantaneous effects and immediate linkages as indicated by the size, direction, and significance of the variables representing them. Such an ordering provides a very valuable basis both for institutional design as well as for its sequential implementation. Given an initial institutional design, the general guideline for its implementation involves the identification of institutional aspects having both the most immediate return in terms of improved water sector performance as well as the most intimate operational linkages with other institutional aspects which are next in the hierarchy of importance. In this way, the implementation of each institutional aspect improves water sector performance even while creating a favorable climate for the implementation of subsequent institutional aspects.

Fourth, the significant positive effect that the constant term has in most contexts suggests clearly the synergy that the institution-performance interaction can derive from the general socio-economic, political, and resource-related environment within which such an interaction occurs. With an overall pro-reform climate, it possible not only to minimize the overall transaction cost of institutional change but also to achieve more than proportionate improvement in water sector performance with a given level of institutional change. The significance of the exogenous factors also suggest that the institutional reforms within water sector need to be approached in a broader context to exploit well the synergy generated by prior, concurrent, and subsequent changes elsewhere in the economy. This also suggests the role that timing of water institutional changes play in determining their effectiveness and impact.

Finally, the results are strongly in favor of a sequential strategy for institutional reform in general and water institution in particular. The main rationale for this strategy lies in the tremendous scope for gainfully exploiting the synergy emerging from both within and outside the water sector. While the strategy of institutional reform at-one-go is economically costly and politically difficult, effecting gradualistic changes within an ordered and sequential framework enhance the feasibility and effectiveness of institutional change in most situations. Since the institutional synergy reduces the transaction costs of subsequent reforms, and the immediate performance impacts of initial reforms ensures a steady flow of economic benefits, the sequential strategy enhances the prospects for institutional change by gradually weakening political resistance even while

precipitating an endogenous pressure for further reforms. The sequential strategy is also more suitable for international lending agencies such as the World Bank with an avowed interest in promoting institutional change in the water sector worldwide. Since this strategy provides a natural framework for temporally and operationally linked long-term lending programs in the institutional sphere of water sector, it is mutually advantageous for both the borrowing countries and the lending agencies.

To conclude, the present study does break new grounds both in terms of its analytical approach and methodological innovation as well as in terms of its policy insights into the process of institution-performance interaction. But, further research is needed to improve the policy value and credibility of this study by extending the analysis in two main directions. First, the empirical basis of the analysis has to be broadened by increasing the sample size--both by adding more countries and water sector experts--and incorporating, thereby, a greater diversity in the context and perception of the institution-performance interaction. Second, the evaluation has to be extended to cover also the layers of interaction among institutional aspects within each water institution component (e.g., the relationship among the legal aspects such as conflict resolution, water rights, and accountability). And, finally, the estimation procedure has to be refined to evaluate together the intricate linkages among various layers of the institution-performance interaction within a sequential or simultaneous system framework. Since a simultaneous estimation can isolate and trace the effects of any institutional aspects throughout the system, it allows the identification of a more accurate institutional design and implementation sequencing than that possible at present. With a well designed and sequential strategy that exploits better the institutional inter-linkages and synergy, the political economy constraint that persists because of an inadequate understanding of the process of institutional change, can be relaxed, and even, be turned into an imperative for change.

Table 1. Overall Performance of Water Law: Relative Role of Major Legal Aspects.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	1.367	1.381	0.176
Treatment of Surface and Sub-surface Water	LTRWSA	Dummy	1.055	2.098	0.043
Format of Surface Water Right	LPRSRF	Category	0.224	1.523	0.137
Effectiveness of Conflict Resolution Provisions	LCRMEE	Scale	0.328	3.371	0.002
Effectiveness of Accountability Provisions	LACPRE	Scale	0.011	0.095	0.925
Degree of Integration Within Water Law	LINTRE	Scale	0.173	2.300	0.028
Tendency for Centralization in Water Law	LOECEN	Scale	-0.065	-0.757	0.454
Scope for Privatization in Water Law	LOEPRV	Scale	0.198	1.704	0.097
R^2	-	-	0.566	-	-
F-Value	-	-	6.526	-	0.000

Table 2. Performance of Water Policy: Relative Role of Major Policy Aspects.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	0.130	0.106	0.916
Project Selection Criteria	PPSCRI	Category	-0.499	-3.132	0.003
Level of Cost Recovery	PCOREC	Category	0.994	3.153	0.003
Effectiveness of Water Transfer Policy	PIRSWE	Scale	0.108	1.190	0.242
Impact of Private Sector Participation Policy	PGPIPP	Scale	-0.118	-1.583	0.122
Impact of User Participation Policy	PGPIUP	Scale	-0.082	-0.894	0.377
Impact of Other Policies on Water Policy	POPAWE	Scale	0.242	1.788	0.082
Overall Linkage Between Law and Policy	POELWL	Scale	0.590	5.189	0.000
R^2	-	-	0.550	-	-
F-Value	-	-	6.118	-	0.000

Table 3. Performance of Water Administration: Relative Role of Major Administrative Aspects.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	1.758	1.339	0.189
Organizational Basis of Water Administration	AORGBA	Category	0.103	0.369	0.714
Balance in Functional Specialization	ABALFS	Dummy	1.587	2.452	0.019
Existence of Independent Water Pricing Body	AIBDWP	Dummy	1.055	1.565	0.127
Seriousness of Budget Constraint	ASBUDC	Scale	0.109	0.934	0.357
Effectiveness of Administrative Accountability	AACCME	Scale	0.072	0.482	0.633
Adequacy of Information	AARINF	Scale	0.141	1.057	0.298
Extent of Science/Technology Application	AEXTST	Scale	0.125	0.728	0.471
R^2	-	-	0.359	-	-
F-Value	-	-	2.799	-	0.020

Table 4. Water Institution Performance: Relative Role of Institutional Components.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	2.200	2.998	0.005
Overall Effectiveness of Water Law	LOEFWL	Scale	0.100	0.675	0.504
Overall Effectiveness of Water Policy	POEFWP	Scale	0.393	2.366	0.023
Overall Effectiveness of Water Administration	AOEFWA	Scale	0.131	1.172	0.248
R^2	-	-	0.387	-	-
F-Value	-	-	8.218	-	0.000

Table 5. Water Institution Performance: Relative Role of Major Institutional Aspects.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	0.914	0.585	0.564
Treatment of Surface and Sub-surface Water	LTRWSA	Dummy	0.348	0.516	0.610
Format of Surface Water Right	LPRSRF	Category	0.175	0.961	0.346
Effectiveness of Accountability Provisions	LCRMEE	Scale	-0.077	-0.663	0.513
Degree of Integration Within Water Law	LINTRE	Scale	-0.021	-0.246	0.807
Tendency for Centralization in Water Law	LOECEN	Scale	-0.057	-0.544	0.591
Scope for Privatization in Water Law	LOEPRV	Scale	0.174	1.421	0.167
Project Selection Criteria	PPSCRI	Category	0.068	0.360	0.722
Level of Cost Recovery	PCOREC	Category	0.446	1.037	0.309
Impact of Other Policies on Water Policy	POPAWE	Scale	0.396	2.494	0.019
Overall Linkage Between Law and Policy	POELWL	Scale	0.177	1.087	0.287
Organizational Basis of Water Administration	AORGBA	Category	-0.288	-1.188	0.246
Balance in Functional Specialization	ABALFS	Dummy	1.166	2.138	0.042
Existence of Independent Water Pricing Body	AIBDWP	Dummy	0.970	1.614	0.119
Seriousness of Budget Constraint	ASBUDC	Scale	-0.040	-0.370	0.714
Effectiveness of Administrative Accountability	AACCME	Scale	-0.159	-1.226	0.231
Extent of Science/Technology Application	AEXTST	Scale	-0.007	-0.039	0.969
R^2	-	-	0.543	-	-
F-Value	-	-	1.930	-	0.066

Table 6. Water Sector Performance: Relative Role of Institutional Components.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	1.969	3.042	0.004
Overall Effectiveness of Water Law	LOEFWL	Scale	0.310	2.362	0.023
Overall Effectiveness of Water Policy	POEFWP	Scale	0.192	1.306	0.199
Overall Effectiveness of Water Administration	AOEFWA	Scale	0.090	0.916	0.365
R^2	-	-	0.416	-	-
F-Value	-	-	9.247	-	0.000

Table 7. Water Sector Performance: Relative Role of Major Institutional Aspects.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	3.311	2.556	0.017
Treatment of Surface and Sub-surface Water	LTRWSA	Dummy	1.318	2.355	0.026
Format of Surface Water Right	LPRSRF	Category	0.106	0.705	0.487
Effectiveness of Accountability Provisions	LCRMEE	Scale	-0.060	-0.624	0.538
Degree of Integration Within Water Law	LINTRE	Scale	0.057	0.792	0.435
Tendency for Centralization in Water Law	LOECEN	Scale	-0.050	-0.579	0.568
Scope for Privatization in Water Law	LOEPRV	Scale	0.167	1.637	0.114
Project Selection Criteria	PPSCRI	Category	-0.120	-0.767	0.450
Level of Cost Recovery	PCOREC	Category	-0.247	-0.692	0.495
Impact of Other Policies on Water Policy	POPAWE	Scale	0.162	1.227	0.231
Overall Linkage Between Law and Policy	POELWL	Scale	0.056	0.413	0.683
Organizational Basis of Water Administration	AORGBA	Category	-0.139	-0.692	0.495
Balance in Functional Specialization	ABALFS	Dummy	0.831	1.836	0.078
Existence of Independent Water Pricing Body	AIBDWP	Dummy	1.110	2.228	0.035
Seriousness of Budget Constraint	ASBUDC	Scale	-0.117	-1.304	0.204
Effectiveness of Administrative Accountability	AACCME	Scale	0.017	0.155	0.878
Extent of Science/Technology Application	AEXTST	Scale	0.003	0.020	0.984
R^2	-	-	0.614	-	-
F-Value	-	-	2.589	-	0.015

Table 8. Effect of Water Institution on Water Sector Performance.

Variable Name	*Acronym*	*Type*	*Coefficient*	*t-Ratio*	*Significance*
Intercept	-	-	1.722	2.867	0.007
Performance of Water Institution	WIPOVL	Scale	0.617	5.995	0.000
R^2	-	-	0.566	-	-
F-Value	-	-	6.526	-	0.000

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APPENDIX-A: DESCRIPTIVE STATISTICS

Table A.1. Mean and Standard Deviation for Legal Variables by Sample Countries.

Country	Legal Linkages	Effectiveness of Provisions for			Inter-govtl. Responsblty	Internal Consistency	Tendency for		Evaluation
		W. Rights	Conf. Resl	Accountblty			Centralizatn	Privatization	
	LLIBWO	LPRORE	LCRMEE	LACPRE	LIGRES	LINTRE	LOECEN	LOEPRV	LOEFWL
Australia	**7.11**	**4.67**	**5.56**	**5.33**	**2.33**	**6.67**	**6.33**	**7.11**	**6.53**
	0.38	*0.58*	*1.39*	*1.53*	*2.08*	*1.53*	*0.58*	*1.84*	*1.01*
Brazil	**7.42**	**4.75**	**5.92**	**3.38**	**2.10**	**5.00**	**3.00**	**7.50**	**6.60**
	1.66	*2.63*	*2.25*	*3.09*	*0.62*	*3.83*	*1.41*	*2.25*	*0.95*
Chile	**1.73**	**3.20**	**4.13**	**5.30**	**1.28**	**0.80**	**4.40**	**6.47**	**5.20**
	1.30	*1.92*	*2.01*	*0.97*	*0.52*	*1.79*	*2.30*	*2.47*	*2.75*
China	**6.11**	**4.67**	**5.11**	**6.33**	**1.60**	**4.33**	**6.00**	**4.89**	**5.53**
	1.64	*0.58*	*1.39*	*1.89*	*0.72*	*4.04*	*1.00*	*3.17*	*0.50*
India	**5.98**	**3.60**	**4.27**	**1.50**	**2.20**	**2.20**	**6.40**	**3.00**	**3.40**
	1.32	*1.34*	*2.42*	*1.27*	*0.45*	*0.45*	*2.07*	*1.43*	*1.29*
Israel	**2.92**	**7.25**	**5.17**	**4.38**	**1.80**	**7.25**	**6.25**	**3.50**	**6.65**
	2.91	*2.22*	*3.55*	*3.35*	*0.57*	*2.22*	*2.87*	*2.53*	*1.45*
Mexico	**5.92**	**4.33**	**7.22**	**6.33**	**1.43**	**3.67**	**7.33**	**6.53**	**6.13**
	2.61	*2.58*	*2.16*	*1.51*	*0.43*	*3.39*	*4.08*	*2.91*	*2.52*
S. Africa	**4.17**	**5.50**	**5.17**	**3.50**	**3.20**	**6.50**	**8.50**	**3.00**	**4.85**
	1.18	*0.71*	*2.59*	*2.12*	*0.85*	*2.12*	*0.71*	*1.89*	*1.91*
Spain	**6.60**	**5.30**	**5.60**	**5.30**	**2.36**	**3.60**	**3.40**	**5.73**	**5.91**
	2.52	*2.95*	*1.14*	*1.35*	*0.59*	*3.91*	*2.70*	*3.02*	*1.22*
Sri Lanka	**5.22**	**2.33**	**0.78**	**4.00**	**1.73**	**2.67**	**5.33**	**5.67**	**2.27**
	3.89	*2.31*	*0.77*	*5.29*	*1.03*	*0.58*	*4.62*	*3.76*	*1.70*
US	**5.22**	**5.67**	**3.00**	**6.50**	**3.67**	**1.33**	**4.00**	**5.89**	**5.67**
	3.20	*1.53*	*3.38*	*2.50*	*0.42*	*2.31*	*2.00*	*2.46*	*0.99*
Overall	**5.30**	**4.59**	**4.91**	**4.72**	**2.04**	**3.77**	**5.44**	**5.48**	**5.40**
	2.66	*2.23*	*2.52*	*2.57*	*0.94*	*3.15*	*2.86*	*2.73*	*2.00*

Table A.2. Mean and Standard Deviation for Legal Variables by Disciplinary Background of Sample Experts.

Field of Expertise	Legal Linkages	Effectiveness of Provisions for			Inter-govtl. Responsblty	Internal Consistency	Tendency for		Evaluation
		W. Rights	Conf. Resl	Accountblty			Centralizatn	Privatization	
	LLIBWO	LPRORE	LCRMEE	LACPRE	LIGRES	LINTRE	LOECEN	LOEPRV	LOEFWL
Economists	**5.30**	**4.32**	**4.20**	**3.85**	**1.91**	**3.94**	**5.00**	**4.78**	**4.66**
	3.08	*2.74*	*2.37*	*2.47*	*0.71*	*2.46*	*3.12*	*3.03*	*2.14*
Engineers	**5.43**	**4.55**	**5.73**	**5.38**	**2.10**	**4.15**	**5.80**	**6.16**	**6.10**
	2.62	*1.54*	*2.62*	*2.65*	*1.13*	*3.50*	*2.67*	*2.48*	*1.79*
Lawyers	**4.83**	**7.00**	**4.50**	**6.13**	**2.30**	**2.25**	**5.50**	**5.58**	**5.75**
	1.93	*1.83*	*2.25*	*1.11*	*1.15*	*4.50*	*2.65*	*1.42*	*0.97*
Others	**4.83**	**2.50**	**3.67**	**2.75**	**2.10**	**1.50**	**5.50**	**4.50**	**4.00**
	1.18	*0.71*	*2.36*	*2.47*	*0.14*	*2.12*	*4.95*	*4.95*	*2.83*
Overall	**5.30**	**4.59**	**4.91**	**4.72**	**2.04**	**3.77**	**5.44**	**5.48**	**5.40**
	2.66	*2.23*	*2.52*	*2.57*	*0.94*	*3.15*	*2.86*	*2.73*	*2.00*

Table A.3. Mean and Standard Deviation for Policy Variables by Sample Countries.

Country	Prj Sel Crit	Price/Cost Recovery		Inter-Regional/Sectoral Water Transfer Policy			
	PPSCRI	PPRREV	PCOREC	PIRSWR	PIRSWM	PIRSWO	PIRSWE
Australia	**6.00**	**3.08**	**3.00**	**4.00**	**4.33**	**1.33**	**6.67**
	0.00	*0.14*	*0.25*	*0.00*	*1.15*	*0.58*	*1.38*
Brazil	**3.50**	**1.31**	**1.56**	**2.00**	**1.50**	**1.75**	**1.63**
	1.00	*0.90*	*0.72*	*1.15*	*1.00*	*0.50*	*1.97*
Chile	**1.60**	**2.35**	**1.60**	**4.00**	**3.00**	**1.00**	**4.20**
	1.57	*0.84*	*1.23*	*0.00*	*2.74*	*0.00*	*2.12*
China	**4.67**	**2.17**	**2.25**	**3.33**	**1.67**	**2.33**	**4.17**
	0.58	*0.52*	*0.43*	*0.58*	*0.58*	*0.58*	*3.61*
India	**3.80**	**1.90**	**1.60**	**2.00**	**2.60**	**1.80**	**2.83**
	1.64	*0.34*	*0.58*	*0.71*	*1.52*	*1.30*	*1.49*
Israel	**2.25**	**3.25**	**2.94**	**2.75**	**1.50**	**1.00**	**4.38**
	1.52	*0.00*	*0.31*	*0.50*	*0.58*	*0.00*	*3.75*
Mexico	**3.67**	**2.83**	**2.38**	**3.00**	**2.67**	**1.83**	**4.35**
	1.59	*0.52*	*0.59*	*0.00*	*1.86*	*0.98*	*3.31*
S. Africa	**3.50**	**2.88**	**2.75**	**2.50**	**2.50**	**3.00**	**3.63**
	0.71	*0.18*	*0.35*	*0.71*	*2.12*	*0.00*	*0.53*
Spain	**2.87**	**2.18**	**2.30**	**3.20**	**2.20**	**1.60**	**2.30**
	2.16	*0.34*	*0.33*	*1.30*	*1.64*	*0.89*	*1.59*
Sri Lanka	**4.11**	**1.08**	**1.50**	**1.00**	**0.33**	**0.33**	**2.17**
	0.84	*0.76*	*0.50*	*1.73*	*0.58*	*0.58*	*3.75*
US	**3.78**	**2.08**	**2.25**	**1.33**	**2.00**	**0.67**	**2.83**
	0.19	*1.13*	*0.90*	*1.53*	*1.73*	*0.58*	*2.75*
Overall	**3.47**	**2.29**	**2.15**	**2.72**	**2.26**	**1.49**	**3.52**
	1.66	*0.83*	*0.78*	*1.20*	*1.69*	*0.91*	*2.63*

Table A.4. Mean and Standard Deviation for Policy Variables by Disciplinary Background of Sample Experts.

Field of Expertise	Prj Sel Crit	Price/Cost Recovery		Inter-Regional/Sectoral Water Transfer Policy			
	PPSCRI	PPRREV	PCOREC	PIRSWR	PIRSWM	PIRSWO	PIRSWE
Economists	**3.24**	**2.10**	**2.03**	**2.82**	**1.65**	**1.24**	**2.76**
	1.79	*0.86*	*0.91*	*1.24*	*1.46*	*0.90*	*2.43*
Engineers	**3.83**	**2.34**	**2.20**	**2.55**	**2.60**	**1.65**	**4.28**
	1.57	*0.84*	*0.66*	*1.19*	*1.76*	*0.93*	*2.67*
Lawyers	**3.33**	**2.63**	**2.50**	**3.00**	**1.75**	**1.75**	**3.25**
	1.56	*0.72*	*0.54*	*1.41*	*0.96*	*0.96*	*3.12*
Others	**2.00**	**2.75**	**1.88**	**3.00**	**5.00**	**1.50**	**2.94**
	1.41	*0.71*	*1.59*	*1.41*	*0.00*	*0.71*	*3.09*
Overall	**3.47**	**2.29**	**2.15**	**2.72**	**2.26**	**1.49**	**3.52**
	1.66	*0.83*	*0.78*	*1.20*	*1.69*	*0.91*	*2.63*

Table A.5. Mean and Standard Deviation for Policy Variables by Sample Countries.

Country	Privatization Policy			User Participation Policy		
	PGPIPP	PEXTPP	PUATPP	PGPIUP	PEXTUP	POATUP
Australia	**6.92**	**6.67**	**4.33**	**3.47**	**3.50**	**5.00**
	1.46	*1.38*	*0.58*	*4.10*	*1.50*	*0.00*
Brazil	**2.19**	**3.50**	**4.25**	**3.58**	**3.29**	**4.00**
	3.89	*1.47*	*0.50*	*2.43*	*1.04*	*0.41*
Chile	**5.55**	**6.25**	**4.80**	**6.03**	**5.53**	**4.70**
	3.71	*2.83*	*0.45*	*3.11*	*3.21*	*0.45*
China	**1.00**	**2.67**	**4.33**	**0.14**	**3.03**	**3.17**
	1.73	*1.53*	*1.15*	*0.24*	*3.17*	*1.04*
India	**1.60**	**1.80**	**3.80**	**2.20**	**2.63**	**3.70**
	1.52	*1.14*	*1.48*	*1.73*	*1.84*	*0.45*
Israel	**4.69**	**4.19**	**3.25**	**3.27**	**1.35**	**2.38**
	3.31	*2.79*	*2.22*	*2.88*	*1.72*	*1.80*
Mexico	**6.25**	**4.48**	**4.33**	**4.78**	**4.96**	**3.67**
	2.52	*3.07*	*0.82*	*3.02*	*1.87*	*1.40*
S. Africa	**5.25**	**1.75**	**3.00**	**5.58**	**2.54**	**4.50**
	2.47	*0.71*	*1.41*	*0.82*	*0.06*	*0.71*
Spain	**5.40**	**3.50**	**3.80**	**5.46**	**4.59**	**4.10**
	3.56	*2.74*	*0.45*	*2.02*	*2.10*	*0.55*
Sri Lanka	**0.00**	**1.42**	**2.33**	**2.75**	**2.50**	**4.00**
	0.00	*1.23*	*0.58*	*1.52*	*1.34*	*1.00*
US	**6.17**	**4.75**	**4.00**	**4.28**	**3.78**	**3.00**
	2.27	*0.66*	*1.73*	*3.84*	*3.36*	*2.65*
Overall	**4.20**	**3.85**	**3.93**	**3.90**	**3.62**	**3.83**
	3.32	*2.53*	*1.18*	*2.81*	*2.29*	*1.22*

Table A.6. Mean and Standard Deviation for Policy Variables by Disciplinary Background of Sample Experts.

Field of Expertise	Privatization Policy			User Participation Policy		
	PGPIPP	PEXTPP	PUATPP	PGPIUP	PEXTUP	POATUP
Economists	**3.09**	**2.54**	**3.53**	**2.98**	**2.56**	**3.74**
	2.89	*2.01*	*1.28*	*2.11*	*1.81*	*1.37*
Engineers	**4.50**	**4.51**	**4.20**	**4.56**	**4.36**	**3.88**
	3.32	*2.39*	*1.06*	*2.97*	*1.96*	*1.18*
Lawyers	**6.75**	**5.13**	**4.50**	**3.71**	**3.52**	**3.63**
	3.05	*1.51*	*0.58*	*2.88*	*2.29*	*1.25*
Others	**5.50**	**5.75**	**3.50**	**5.46**	**5.42**	**4.50**
	6.36	*6.01*	*2.12*	*6.42*	*6.48*	*0.71*
Overall	**4.20**	**3.85**	**3.93**	**3.90**	**3.62**	**3.83**
	3.32	*2.53*	*1.18*	*2.81*	*2.29*	*1.22*

Table A.7. Mean and Standard Deviation for Policy Variables by Sample Countries.

Country	NGO Participation Policy					Effect of Other Policies		Evaluation	
	PNGOOP	PNGOUG	PNGOPS	PNGOFA	PNGOFP	POPAWN	POPAWE	POELWL	POEFWP
Australia	**6.10**	**2.87**	**2.90**	**0.00**	**0.97**	**6.33**	**6.00**	**8.00**	**6.87**
	0.44	*0.12*	*0.10*	*0.00*	*1.00*	*2.08*	*1.50*	*0.00*	*0.31*
Brazil	**1.21**	**1.03**	**1.33**	**2.05**	**0.43**	**4.00**	**6.90**	**7.50**	**6.77**
	2.22	*2.05*	*2.65*	*3.35*	*0.85*	*2.00*	*1.62*	*1.91*	*1.22*
Chile	**3.89**	**3.42**	**3.90**	**1.18**	**0.98**	**5.00**	**4.86**	**7.20**	**6.11**
	1.71	*1.95*	*2.76*	*1.59*	*0.93*	*1.58*	*1.51*	*1.30*	*1.53*
China	**5.00**	**1.63**	**0.20**	**2.00**	**0.37**	**4.67**	**4.88**	**6.67**	**5.72**
	3.61	*2.25*	*0.35*	*2.09*	*0.32*	*2.08*	*0.87*	*2.08*	*2.00*
India	**3.08**	**2.94**	**1.62**	**2.34**	**1.72**	**6.20**	**6.18**	**4.40**	**3.70**
	1.13	*1.27*	*1.11*	*1.99*	*1.72*	*1.30*	*1.37*	*3.36*	*1.50*
Israel	**3.73**	**1.99**	**1.38**	**0.00**	**0.00**	**6.00**	**4.86**	**6.00**	**7.12**
	2.91	*1.69*	*1.60*	*0.00*	*0.00*	*1.15*	*2.13*	*2.71*	*2.57*
Mexico	**4.44**	**2.67**	**4.07**	**1.87**	**0.98**	**3.17**	**6.68**	**6.83**	**5.00**
	1.97	*1.84*	*2.42*	*2.70*	*1.23*	*0.98*	*0.96*	*1.94*	*1.80*
S. Africa	**4.29**	**3.15**	**5.55**	**0.50**	**0.50**	**7.50**	**3.38**	**8.00**	**4.60**
	4.48	*2.47*	*6.29*	*0.71*	*0.71*	*0.71*	*2.30*	*0.00*	*0.75*
Spain	**5.49**	**4.16**	**4.44**	**2.36**	**3.28**	**4.80**	**5.13**	**7.40**	**5.79**
	2.67	*2.06*	*2.14*	*2.86*	*2.89*	*1.92*	*1.34*	*1.34*	*1.16*
Sri Lanka	**4.19**	**4.77**	**1.50**	**3.40**	**1.43**	**2.67**	**4.97**	**4.33**	**1.94**
	1.82	*2.90*	*1.05*	*1.44*	*1.36*	*0.58*	*3.27*	*3.06*	*0.62*
US	**1.45**	**1.37**	**1.43**	**0.00**	**0.00**	**4.67**	**6.50**	**8.33**	**5.49**
	1.30	*2.37*	*1.69*	*0.00*	*0.00*	*2.08*	*1.80*	*0.58*	*1.21*
Overall	**3.89**	**2.76**	**2.66**	**1.53**	**1.09**	**4.86**	**5.62**	**6.70**	**5.41**
	2.41	*2.01*	*2.48*	*2.11*	*1.57*	*1.88*	*1.73*	*2.22*	*1.94*

Table A.8. Mean and Standard Deviation for Policy Variables by Disciplinary Background of Sample Experts.

Field of	NGO Participation Policy					Effect of Other Policies		Evaluation	
Expertise	PNGOOP	PNGOUG	PNGOPS	PNGOFA	PNGOFP	POPAWN	POPAWE	POELWL	POEFWP
Economists	**3.70**	**3.13**	**2.21**	**1.32**	**1.38**	**4.71**	**5.59**	**5.41**	**4.70**
	2.35	*2.14*	*2.11*	*1.52*	*1.73*	*1.79*	*1.67*	*2.53*	*2.27*
Engineers	**4.18**	**2.65**	**3.30**	**1.81**	**0.83**	**5.05**	**5.89**	**7.90**	**6.05**
	2.53	*2.07*	*2.87*	*2.60*	*1.20*	*2.11*	*1.86*	*1.12*	*1.35*
Lawyers	**4.01**	**2.55**	**2.58**	**1.43**	**1.58**	**4.50**	**5.51**	**7.25**	**5.62**
	2.81	*1.48*	*1.44*	*2.47*	*2.76*	*1.73*	*1.02*	*1.71*	*2.13*
Others	**2.50**	**1.25**	**0.25**	**0.85**	**0.25**	**5.00**	**3.50**	**4.50**	**4.73**
	2.12	*1.06*	*0.35*	*0.49*	*0.35*	*1.41*	*1.41*	*2.12*	*3.21*
Overall	**3.89**	**2.76**	**2.66**	**1.53**	**1.09**	**4.86**	**5.62**	**6.70**	**5.41**
	2.41	*2.01*	*2.48*	*2.11*	*1.57*	*1.88*	*1.73*	*2.22*	*1.94*

Table A.9. Mean and Standard Deviation for Administrative Variables by Sample Countries.

Country	Influence of Government Layers				Organizational Features		
	AGBIWN	AGBIWR	AGBIWL	AGBIWS	ADOMID	AACORD	AORGBA
Australia	**3.56**	**7.67**	**4.67**	**5.11**	**8.67**	**7.00**	**3.00**
	1.39	*2.33*	*0.67*	*2.04*	*0.58*	*1.73*	*1.00*
Brazil	**5.83**	**6.50**	**5.42**	**1.92**	**6.00**	**3.25**	**4.00**
	1.60	*1.55*	*2.41*	*2.32*	*4.08*	*2.50*	*1.63*
Chile	**3.93**	**2.27**	**1.33**	**1.47**	**7.20**	**5.60**	**1.20**
	2.73	*2.58*	*1.55*	*2.33*	*4.21*	*1.14*	*0.45*
China	**7.22**	**7.11**	**7.67**	**2.00**	**8.33**	**5.00**	**4.00**
	2.67	*1.54*	*2.31*	*3.46*	*1.53*	*1.00*	*0.00*
India	**2.90**	**5.63**	**2.67**	**4.53**	**7.40**	**4.40**	**1.20**
	1.37	*2.19*	*3.37*	*2.64*	*0.55*	*1.52*	*0.45*
Israel	**7.58**	**3.92**	**2.79**	**1.17**	**0.00**	**1.75**	**1.00**
	1.85	*0.79*	*1.81*	*2.33*	*0.00*	*3.50*	*0.00*
Mexico	**6.17**	**5.28**	**3.89**	**4.44**	**2.50**	**4.33**	**3.17**
	1.59	*2.28*	*2.41*	*3.42*	*3.02*	*4.23*	*0.98*
S. Africa	**5.83**	**3.83**	**3.83**	**3.34**	**8.00**	**5.50**	**2.00**
	3.06	*2.12*	*0.71*	*0.47*	*1.41*	*0.71*	*0.00*
Spain	**4.20**	**4.20**	**4.47**	**2.13**	**4.70**	**2.20**	**3.40**
	1.50	*2.27*	*1.76*	*3.75*	*3.19*	*2.17*	*0.89*
Sri Lanka	**5.00**	**4.44**	**3.56**	**3.44**	**3.33**	**4.33**	**1.67**
	2.89	*2.52*	*2.46*	*2.27*	*4.16*	*1.15*	*0.58*
US	**5.33**	**6.67**	**4.11**	**2.33**	**6.00**	**5.33**	**2.67**
	1.00	*1.15*	*2.36*	*2.52*	*5.20*	*4.62*	*1.53*
Overall	**5.14**	**5.10**	**3.86**	**2.91**	**5.36**	**4.26**	**2.47**
	2.26	*2.39*	*2.49*	*2.80*	*3.77*	*2.77*	*1.35*

Table A.10. Mean and Standard Deviation for Administrative Variables by Disciplinary Background of Sample Experts.

Field of Expertise	Influence of Government Layers				Organizational Features		
	AGBIWN	AGBIWR	AGBIWL	AGBIWS	ADOMID	AACORD	AORGBA
Economists	**4.44**	**4.13**	**2.78**	**2.53**	**4.50**	**3.71**	**2.24**
	2.09	*1.70*	*1.74*	*2.11*	*3.64*	*2.42*	*1.20*
Engineers	**5.67**	**5.87**	**5.06**	**3.48**	**6.50**	**4.85**	**2.70**
	2.23	*2.84*	*2.65*	*3.37*	*3.53*	*2.92*	*1.45*
Lawyers	**6.17**	**5.50**	**4.17**	**2.42**	**4.00**	**3.25**	**3.00**
	2.29	*1.82*	*1.45*	*2.79*	*4.69*	*3.95*	*1.41*
Others	**3.67**	**4.84**	**0.50**	**1.33**	**4.00**	**5.00**	**1.00**
	3.30	*1.65*	*0.71*	*1.89*	*5.66*	*1.41*	*0.00*
Overall	**5.14**	**5.10**	**3.86**	**2.91**	**5.36**	**4.26**	**2.47**
	2.26	*2.39*	*2.49*	*2.80*	*3.77*	*2.77*	*1.35*

Table A.11. Mean and Standard Deviation for Administrative Variables by Sample Countries.

Country	Functional Capacity			Finance	Regulation and Accountability			
	AOFCAP	ABALFS	ASREPU	ASBUDC	AREGMN	AREGME	AACCMN	AACCME
Australia	**6.93**	**0.67**	**6.33**	**6.67**	**9.00**	**7.75**	**5.67**	**5.75**
	0.93	*0.58*	*2.08*	*1.15*	*0.00*	*1.09*	*4.16*	*1.52*
Brazil	**4.68**	**0.25**	**3.00**	**2.75**	**3.50**	**3.91**	**1.25**	**2.50**
	1.43	*0.50*	*3.83*	*3.20*	*2.89*	*3.27*	*1.89*	*3.32*
Chile	**4.03**	**0.60**	**0.00**	**3.60**	**4.00**	**5.64**	**2.80**	**6.78**
	2.88	*0.55*	*0.00*	*3.05*	*2.00*	*3.37*	*1.30*	*2.84*
China	**4.67**	**0.33**	**4.00**	**0.00**	**6.33**	**5.42**	**6.00**	**5.14**
	4.08	*0.58*	*3.61*	*0.00*	*2.52*	*0.80*	*2.00*	*2.83*
India	**4.15**	**0.20**	**5.60**	**7.00**	**6.00**	**3.11**	**5.80**	**3.58**
	1.50	*0.45*	*2.07*	*1.22*	*1.73*	*1.16*	*2.49*	*0.93*
Israel	**3.82**	**0.75**	**0.00**	**4.25**	**5.00**	**6.36**	**3.50**	**3.63**
	2.63	*0.50*	*0.00*	*3.50*	*1.83*	*2.51*	*2.52*	*3.33*
Mexico	**4.46**	**0.67**	**4.83**	**1.50**	**7.50**	**5.52**	**6.67**	**6.55**
	2.52	*0.52*	*2.04*	*2.07*	*1.64*	*2.07*	*2.16*	*1.31*
S. Africa	**5.00**	**1.00**	**6.00**	**6.00**	**5.50**	**6.48**	**7.50**	**7.46**
	1.10	*0.00*	*2.83*	*1.41*	*3.54*	*1.15*	*3.54*	*0.41*
Spain	**5.52**	**0.40**	**2.70**	**3.60**	**6.00**	**5.42**	**5.20**	**4.56**
	1.64	*0.55*	*1.86*	*3.91*	*2.24*	*1.11*	*3.42*	*2.59*
Sri Lanka	**5.04**	**0.00**	**3.00**	**4.00**	**2.67**	**3.89**	**4.33**	**4.58**
	1.83	*0.00*	*2.65*	*3.61*	*3.06*	*2.78*	*4.16*	*0.63*
US	**5.61**	**1.00**	**0.00**	**2.33**	**4.67**	**6.53**	**1.67**	**3.00**
	1.73	*0.00*	*0.00*	*4.04*	*0.58*	*1.33*	*2.08*	*3.00*
Overall	**4.79**	**0.51**	**3.13**	**3.70**	**5.53**	**5.32**	**4.56**	**4.86**
	2.12	*0.51*	*2.96*	*3.20*	*2.49*	*2.29*	*3.02*	*2.57*

Table A.12. Mean and Standard Deviation for Administrative Variables by Disciplinary Background of Sample Experts.

Field of Expertise	Functional Capacity			Finance	Regulation and Accountability			
	AOFCAP	ABALFS	ASREPU	ASBUDC	AREGMN	AREGME	AACCMN	AACCME
Economists	**4.16**	**0.41**	**2.74**	**4.24**	**4.94**	**4.55**	**4.88**	**4.52**
	2.04	*0.51*	*2.48*	*3.35*	*2.54*	*2.48*	*3.08*	*2.16*
Engineers	**5.65**	**0.60**	**3.90**	**3.70**	**6.15**	**5.96**	**4.80**	**5.78**
	1.46	*0.50*	*3.26*	*2.99*	*2.68*	*2.00*	*3.12*	*2.56*
Lawyers	**4.75**	**0.75**	**0.75**	**2.00**	**5.00**	**5.85**	**2.00**	**2.08**
	3.41	*0.50*	*1.50*	*4.00*	*1.41*	*1.97*	*2.31*	*2.83*
Others	**1.61**	**0.00**	**3.50**	**2.50**	**5.50**	**4.42**	**4.50**	**4.08**
	2.28	*0.00*	*4.95*	*3.54*	*0.71*	*3.65*	*0.71*	*1.53*
Overall	**4.79**	**0.51**	**3.13**	**3.70**	**5.53**	**5.32**	**4.56**	**4.86**
	2.12	*0.51*	*2.96*	*3.20*	*2.49*	*2.29*	*3.02*	*2.57*

Table A.13. Mean and Standard Deviation for Administrative Variables by Sample Countries.

Country	Information, Research, and Technological Capabilities							Evaluation
	AARINF	AILINK	AILWRI	AILWES	AILWUR	ARELWR	AEXTST	AOEFWA
Australia	**4.67**	**5.94**	**6.17**	**5.83**	**5.83**	**5.33**	**4.17**	**6.67**
	4.16	*1.23*	*1.61*	*1.04*	*1.04*	*0.58*	*3.61*	*2.08*
Brazil	**6.38**	**3.88**	**4.13**	**2.50**	**5.00**	**5.25**	**3.75**	**4.25**
	2.69	*2.64*	*3.28*	*2.35*	*3.72*	*3.77*	*3.08*	*1.71*
Chile	**5.00**	**2.97**	**3.10**	**2.90**	**2.90**	**4.00**	**5.72**	**5.60**
	3.08	*1.82*	*1.98*	*1.85*	*1.85*	*3.39*	*1.82*	*3.05*
China	**7.33**	**6.06**	**6.17**	**6.17**	**5.83**	**6.00**	**4.97**	**7.00**
	1.61	*0.63*	*0.29*	*2.02*	*0.29*	*1.00*	*1.79*	*1.73*
India	**5.00**	**3.41**	**3.24**	**3.80**	**3.20**	**4.20**	**2.97**	**4.80**
	1.77	*1.26*	*1.35*	*1.40*	*1.44*	*1.30*	*1.34*	*2.17*
Israel	**6.75**	**4.25**	**4.13**	**4.50**	**4.13**	**6.25**	**5.35**	**5.75**
	2.90	*3.19*	*3.28*	*3.70*	*2.59*	*2.63*	*2.61*	*2.75*
Mexico	**7.08**	**5.83**	**6.42**	**5.67**	**5.42**	**5.00**	**5.17**	**5.50**
	1.11	*1.74*	*1.93*	*1.99*	*1.59*	*2.61*	*1.65*	*2.07*
S. Africa	**6.75**	**8.17**	**8.25**	**7.75**	**7.00**	**7.50**	**6.20**	**4.50**
	1.77	*0.94*	*1.06*	*0.35*	*0.71*	*0.71*	*1.84*	*0.71*
Spain	**6.00**	**4.63**	**4.80**	**4.40**	**4.70**	**4.80**	**4.14**	**5.00**
	2.85	*1.69*	*2.17*	*1.82*	*2.22*	*2.39*	*1.41*	*2.55*
Sri Lanka	**4.67**	**5.28**	**5.00**	**5.50**	**5.33**	**4.00**	**2.93**	**2.33**
	2.52	*3.40*	*3.61*	*3.50*	*3.21*	*3.46*	*2.22*	*0.58*
US	**6.50**	**6.06**	**6.17**	**5.67**	**6.33**	**7.33**	**4.93**	**7.67**
	3.46	*1.71*	*1.53*	*1.04*	*2.57*	*0.58*	*0.76*	*0.58*
Overall	**6.00**	**4.86**	**4.98**	**4.71**	**4.81**	**5.21**	**4.53**	**5.35**
	2.46	*2.21*	*2.43*	*2.33*	*2.25*	*2.44*	*2.07*	*2.28*

Table A.14. Mean and Standard Deviation for Administrative Variables by Disciplinary Background of Sample Experts.

Field of Expertise	Information, Research, and Technological Capabilities							Evaluation
	AARINF	AILINK	AILWRI	AILWES	AILWUR	ARELWR	AEXTST	AOEFWA
Economists	**5.32**	**3.86**	**3.69**	**3.94**	**3.94**	**3.94**	**3.81**	**3.94**
	2.31	*2.28*	*2.33*	*2.31*	*2.42*	*2.41*	*2.36*	*2.30*
Engineers	**6.65**	**5.78**	**6.15**	**5.48**	**5.58**	**6.20**	**5.30**	**6.05**
	2.41	*1.96*	*2.13*	*2.34*	*1.96*	*2.21*	*1.70*	*1.82*
Lawyers	**5.63**	**5.42**	**5.50**	**4.75**	**6.00**	**5.75**	**4.00**	**7.25**
	3.33	*1.49*	*1.68*	*2.22*	*0.82*	*2.22*	*1.39*	*1.71*
Others	**6.00**	**3.00**	**3.25**	**3.50**	**2.25**	**5.00**	**4.10**	**6.50**
	2.83	*0.71*	*1.77*	*0.00*	*0.35*	*0.00*	*2.83*	*0.71*
Overall	**6.00**	**4.86**	**4.98**	**4.71**	**4.81**	**5.21**	**4.53**	**5.35**
	2.46	*2.21*	*2.43*	*2.33*	*2.25*	*2.44*	*2.07*	*2.28*

Table A.15. Mean and Standard Deviation for Performance Variables by Sample Countries.

Country	Performance of Water Sector Performance					Water Institution Performance
	Physical	Financial	Economic	Equity	Overall	
	WSPPHY	WSPFIN	WSPECO	WSPEQU	WSPOEV	WIPOEV
Australia	6.53	5.83	6.33	5.56	6.06	8.33
	0.97	*1.61*	*1.61*	*3.37*	*1.31*	*0.58*
Brazil	6.20	5.00	5.13	4.00	5.08	6.50
	0.20	*1.15*	*0.48*	*1.52*	*0.29*	*1.29*
Chile	6.50	7.20	6.50	4.60	6.20	6.20
	0.31	*0.57*	*1.84*	*1.46*	*0.85*	*0.84*
China	6.00	5.75	5.75	6.50	6.00	5.50
	0.35	*0.25*	*0.25*	*0.17*	*0.10*	*0.50*
India	3.26	2.85	1.45	3.47	2.76	4.00
	0.71	*0.82*	*0.45*	*0.90*	*0.52*	*1.58*
Israel	7.45	7.25	6.38	7.75	7.21	6.50
	1.18	*0.87*	*1.11*	*1.13*	*0.79*	*0.58*
Mexico	5.70	4.78	4.56	5.41	5.11	4.90
	0.55	*0.82*	*2.23*	*1.41*	*1.16*	*1.45*
S. Africa	5.53	3.00	1.00	2.67	3.05	4.00
	0.18	*0.00*	*0.00*	*0.00*	*0.04*	*0.00*
Spain	5.57	4.39	3.73	6.20	4.97	4.93
	0.67	*1.11*	*2.29*	*0.79*	*1.00*	*0.90*
Sri Lanka	4.42	2.75	1.00	4.83	3.25	3.00
	0.16	*0.25*	*0.00*	*0.83*	*0.23*	*1.00*
US	6.03	7.83	6.50	6.78	6.79	8.00
	0.12	*1.26*	*0.00*	*2.01*	*0.79*	*1.00*
Overall	5.71	5.17	4.48	5.28	5.16	5.57
	2.36	*2.42*	*2.37*	*2.34*	*2.27*	*2.47*

Table A.16. Mean and Standard Deviation for Performance Variables by Disciplinary Background of Sample Experts.

Field of Expertise	Performance of Water Sector Performance					Water Institution Performance
	Physical	Financial	Economic	Equity	Overall	
	WSPPHY	WSPFIN	WSPECO	WSPEQU	WSPOEV	WIPOEV
Economists	5.29	4.59	3.56	5.14	4.64	4.79
	1.38	*1.83*	*2.71*	*1.65*	*1.64*	*1.65*
Engineers	5.89	5.41	4.99	5.43	5.43	6.08
	1.03	*1.88*	*2.16*	*2.10*	*1.50*	*1.52*
Lawyers	6.33	5.69	5.06	6.04	5.78	6.63
	1.37	*1.55*	*1.51*	*0.93*	*0.94*	*1.11*
Others	5.35	5.00	3.00	4.33	4.42	4.00
	1.48	*2.83*	*2.12*	*1.41*	*1.96*	*2.83*
Overall	5.67	5.10	4.35	5.32	5.11	5.53
	1.23	*1.85*	*2.41*	*1.81*	*1.55*	*1.71*

APPENDIX-B: THE QUESTIONNAIRE

COMPARATIVE STUDY OF WATER INSTITUTIONS AND THEIR IMPACT ON WATER SECTOR PERFORMANCE IN SELECT COUNTRIES

(A World Bank-funded Research Project)

REQUEST to RESPONDENTS

Knowing fully well the value of your time and information, it is our intention to use them as efficiently as we can and, of course, with full acknowledgement of your specific views and contributions (unless stated specifically to the contrary). Thanks, in advance, for your interest, co-operation, and active support to this pioneering study.

(A) Definitions

1. Water Institution = An entity defined interactively by both formal and informal as well as macro and micro level water law, water policy, and water administration.

2. Water Sector = Covers all consumptive uses of water like irrigation, domestic consumption, and industrial processing from both surface and sub-surface sources as well as reclaimed or recycled sources. Non-consumptive uses like hydro-power generation, navigation, and in-stream and ecological needs are considered only to the extent they affect consumptive uses either directly or indirectly.

3. Water Sector Performance = Covers physical performance (Demand vs. Supply), operational performance (allocational ease and its efficiency), and financial performance (cost recovery and pricing efficiency)

(B) Notes

1. This questionnaire is intended essentially to highlight major issues as a starting point to initiate discussion and **elicit gut-feeling response** of country experts, specialists, and policy-makers. Since it does not exhaust all issues (especially the country-specific ones), **additional issues are most welcome to be brought to our attention.** Your valuable comments/suggestions on and modifications/refinements of specific issues are of utmost value as we plan to further fine-tune this questionnaire and mail/email/fax it to many experts worldwide subsequent to this initial survey.

2. Given the nature of the subject under study, questions with straightforward quantitative answers are inter-related with questions that allow only qualitative or **judgmental response**. The latter set of questions can be quantified by carefully

choosing a value on a 1 to 10 scale ***(1 = the least and 10 = the best)*** along with the reason(s) justifying the choice of the assigned value.

3. Inter-connectivity among issues makes the questions not only inter-related but also repetitive. The repetition of the same questions in different contexts is deliberately intended to cross-check the response as well as to capture the multifarious effects of the same aspect in different institutional and performance contexts.

4. **Kindly try to answer all the questions in all the three section** of this questionnaire. Since we aim at evaluating the inter-linkages among the three components of water institution (water law, water policy, and water administration), a **completely responded questionnaire is critical.**

5. Besides the structural questionnaire and open-ended discussion, we also seek your help/direction in obtaining published/unpublished materials and data on water institution and water sector performance.

RESPONDENT'S NAME AND BACKGROUND

1. Respondent's Name (Optional) .....

2. Specialization — Economist/Engineer/Legal expert/ Others (specify).....

3. Affiliation .....

4. Address .....
.....
.....
.....
.....
Email:.....
Phone:.....
Fax:.....

5. Any Other Relevant Information: .....
.....
.....

1. WATER LAW

1.1. Legal Treatment of Different Water Sources
(Tick one or more)

(a) Surface and groundwater are treated alike .....
(b) They are treated differently .....
(c) Laws discriminate water development/use by public and private parties .....
(d) Law distinguishes water development/use across sectors like irrigation, domestic, and industrial uses .....
(e) Differential priority and treatment of consumptive and non-consumptive uses. .....

1.2. Legal Linkages Between Water and Water-related Resources

1.2.1. In your perception, how strong are the legal linkages *(on a 0 to 10 scale)*

(a) Between land and groundwater .....
(b) Between land and surface water .....
(c) Between forest/environment and water .....

1.3. Property Rights Status (*Local Level*)

1.3.1. Whether water law allows private water rights Yes/No

1.3.2. If yes, is it is in the form of *(Tick one or more)*:

(a) Individual rights .....
(b) Group/collective rights .....
(c) Other forms (specify)
....
....

1.4.3. If no, what are the constraints *(Tick one or more)*?

(a) Public control is needed for equity .....
(b) Administration of private rights is socially difficult .....
(c) Gaps in water measuring technology and water control institutions .....
(d) Others (specify)
....
....

1.5. Property Rights Status (*General*)

1.5.1. Basis for general rights in surface water *(Tick one or more)*

(a)	None or not clear	.....
(b)	Common/state property	.....
(c)	Riparian system	.....
(d)	Appropriative system	.....
(e)	Correlative system (Equal or proportional sharing)	.....
(f)	Any other, please specify	.....

1.5.2. Basis for general rights in groundwater *(Tick one or more)*

(a)	Open access	.....
(b)	Common/state property	.....
(c)	Appropriative system	.....
(d)	Correlative system (Equal or proportional sharing)	.....
(e)	Any other, please specify	.....

1.5.3. Is there legalized inter-sectoral prioritization? Yes/No

1.5.3.1. If yes, specify the priority order *(by placing rank number)*

(a)	Domestic use	.....
(b)	Irrigation	.....
(c)	Industrial/commercial uses	.....
(d)	Power generation	.....
(e)	Navigation	.....
(f)	Environmental purpose (e.g., in-stream needs)	.....

1.5.3.2. What is the main basis of such prioritization?
(Tick one. If you tick more than one, indicate the relative importance on a 0 to 10 scale)

(a)	Equity concerns	.....
(b)	Resource conditions	.....
(c)	Economic considerations	.....
(d)	Any other, specify (e.g., historical reasons)	.....
	.....	.....

1.6. Conflict Resolution/Co-ordination

1.6.1. Are the conflict resolution mechanisms explicitly specified in law? Yes/No/Not Clear

1.6.2. If yes, indicate the kind of conflict resolution mechanisms

			(Tick)	*(Tick)*
(a)	Administratively/bureaucratically rooted system			.....
	(Water Resource Dept., Irrigation Dept., etc.)			.....
	(i)	Local administration/govt.	.....	
	(ii)	National Water Council	.....	
(b)	Relatively more decentralized system			.....
	(i)	River boards	.....	
	(ii)	Basin organization	.....	
	(iii)	Any others, specify (e.g., WUA)		
		.....	.....	
		.....	.....	
		.....	.....	
(c)	Tribunals			.....
(d)	Judicial/legislative/constitutional			.....
(e)	Any Others, specify			
	.....			.....

1.6.3. What are the legally specified mechanisms for trans-boundary conflicts (inter-state and international)?

(a)	River boards	.....
(b)	Basin organizations	.....
(c)	Tribunals	.....
(d)	Others specify	
	.....	.....

1.6.4. In your learned judgement, how effective are the legal provisions for conflict resolution/co-ordination mechanisms *(on a 0 to 10 scale)*?

(a)	Local level (among users)	.....
(b)	National level (among regions/sectors)	.....
(c)	International level (among nations)	.....

1.7. Accountability of Water Sector Officials and Water Users

1.7.1. Are there explicit legal provisions for ensuring the accountability of officials/water suppliers/users? Yes/No/Not Clear

1.7.2. If yes, specify the legal instruments for the accountability of *(Tick one or more in each case)*

(a) Officials	(i)	Indemnity clause in water law	.....
	(ii)	Penalty provisions in water law	.....
	(iii)	Other administrative actions	.....
(b) Users	(i)	Sanctions/tortiuous liabilities	.....
	(ii)	User-oriented/decentralized Mechanisms (e.g., Water user Associations)	.....
	(iii)	Actions by local govt./ irrigation department/ water supply agency, etc.	.....

1.7.3. In your learned judgement, how effective are the accountability provisions? *(on a 0 to 10 scale)*

(a) For the officials .....
(b) For the users .....

1.7.4. Do the accountability provisions vary by

(a) Water sources .....
(b) Use Categories .....
(c) User groups .....
(d) None .....

1.8. Intra-governmental Responsibility in Water Law

1.8.1. Please indicate *(by ticking)* current intra-governmental responsibility

Govt. Layer	*Surface Water*	*Ground Water*	*Recycled Water*	*Water Quality*	*Environ -ment*
National	.....	.....	.....	.....	.....
State	.....	.....	.....	.....	.....
Local	.....	.....	.....	.....	.....

1.8.2. Does the existing division of legal responsibility favor an integrated treatment of water planning/development? Yes/No

1.8.3. If yes, how strong is such favorable effect *(on a 0 to 10 scale)*? .....

1.8.4. Is there a legally conceivable property rights in water quality (i.e., pollution permits)? Yes/No

1.8.5. Please specify the legal provisions for pollution Control.
(a) Quality standards .....
(b) Pollution control legislations .....
(c) Any other, Specify
....

1.8.6. In your opinion, how effective are the overall legal provisions in protecting water quality *(on a 0 to 10 scale)*? .....

1.9. Overall Evaluation

1.9.1. Does the present law tend to contribute to centralization? Yes/No

1.9.2. In your opinion, how strong is the tendency towards centralization *(on a 0 to 10 scale)* ? .....

1.9.3. How favorable are the legal provisions for private sector/Non-Governmental Organization (NGO)/community participation in water planning/development/management *(on a 0 to 10 scale)*?
Private sector .....
NGO .....
Community .....

1.9.4. In your opinion, how synergetic (or integrated are water laws and other laws related to land, forest, and environment *(on a 0 to 10 scale)*? .....

1.9.5. In your opinion, how relevant are the water and related laws for the current situation *(on a 0 to 10 scale)* .....

1.9.6. How strong is water law in addressing new challenges in the sphere of
(a) Water sharing conflicts *(on a 0 to 10 scale)* .....
(b) Environmental concerns *(on a 0 to 10 scale)* .....
(c) New water technologies *(on a 0 to 10 scale)* .....

2. WATER POLICY

2.1. Water Policy Implications in Other Policies and Law *(Tick one or more)*

(a)	water law	.....
(b)	agricultural policy	.....
(c)	fiscal policies	.....
(d)	credit/investment policies	.....
(e)	environmental policies	.....

2.2. Priority of Uses

2.2.1. If inter-sectoral use priority is not explicit in water law, is it stated--explicitly or implicitly--in other policies? Yes/No

2.2.2. If yes, specify the order *(By placing a rank)*

(a)	Domestic use	.....
(b)	Irrigation	.....
(c)	Industrial/commercial use	.....
(d)	Power generation	.....
(e)	Navigation	.....
(f)	Environmental purpose (in stream use, etc.)	.....

2.2.3. Is such prioritization rooted more in *(Tick one or more)*

(a)	Equity concerns	.....
(b)	Resource conditions	.....
(c)	Economic considerations	.....
(d)	Any other, specify (e.g., historical reasons)	.....

2.3. Project Selection Criteria

2.3.1. Indicate *(by ticking)* the dominant criteria used in water project selection

Criterion		*Irrigation Project*	*Urban Project*	*Multi-purpose Scheme*
(a)	Benefit-cost ratio	.....	.....	.....
(b)	Internal rate of return	.....	.....	.....
(c)	Equity factors	.....	.....	.....
(d)	Ecological factors	.....	.....	.....
(e)	Other specify	.....	.....	.....

2.3.2. In case more than one criterion is used, please indicate your *judgmental percentage (or proportion)* of projects using each criteria

Criterion		*Irrigation Project*	*Urban Project*	*Multi-purpose Scheme*
(a)	Benefit-cost ratio	.....	.....	.....
(b)	Internal rate of return	.....	.....	.....
(c)	Equity factors	.....	.....	.....
(d)	Ecological factors	.....	.....	.....
(e)	Other specify			
	.....	.....	.....	.....

2.3.3. In case the project selection criteria vary by the type of projects, please indicate *(by ticking)*.

Criterion	*Local Fund*	*Foreign Fund/aid*	*New Construction*	*Improving old projects*	*Managerial/ Institutional Improvement*
(a) Benefit-cost ratio	.....	.....	.....	.....	.....
(b) Internal rate of return	.....	.....	.....	.....	.....
(c) Equity factors	.....	.....	.....	.....	.....
(d) Ecological factors	.....	.....	.....	.....	.....
(e) Other specify					
.....	.....	.....	.....	.....	.....

2.3.4. Do you feel that the recent trend in project selection criteria is towards economic orientation? Yes/No

2.4. Pricing and Cost Recovery

2.4.1. How often water prices/charges are revised *(Please tick)*?

	Irrigation	*Domestic Use*		*Industrial*
		Urban	*Rural*	
(a) Often	.....	.....	.....	.....
(b) Infrequently	.....	.....	.....	.....
(c) Rarely	.....	.....	.....	.....
(d) Not revised	.....	.....	.....	.....

2.4.2. Is water pricing based on *(Please tick)*

	Irrigation	*Domestic Use*		*Industrial*
		Urban	*Rural*	
(a) Fullcost recovery	.....	.....	.....	.....
(b) Partial recovery (Operating cost only)	.....	.....	.....	.....
(c) Full subsidy	.....	.....	.....	.....

2.5. Inter-regional and inter-sectoral water transfers

2.5.1. Are there well established policies or precedent for

(a) Inter-regional water transfers	Yes/No
(b) Inter-sectoral water transfers	Yes/No

2.5.2. If yes, what is the dominant basis for such transfers *(Tick one or more)*?

		Inter-regional	*Inter-sectoral*
(a)	Equity concerns	.....	.....
(b)	Resource conditions	.....	.....
(c)	Economic considerations	.....	.....
(d)	Any other, specify	.....	.....

2.5.3. What is the dominant means for such water transfers *(Tick one or more)*?

		Inter-regional	*Inter-sectoral*
(a)	Purely a political decision	.....	.....
(b)	Administrative dictates	.....	.....
(c)	Negotiation	.....	.....
(d)	Water Market		
	(i) macro	.....	.....
	(ii) micro	.....	.....
(e)	Any other, specify	.....	.....

2.5.4. What is the organizational basis for such water transfers *(Tick one or more)*?

		Inter-regional	*Inter-sectoral*
(a)	River Boards	.....	.....
(b)	Basin Level Organizations	.....	.....
(c)	Tribunals	.....	.....
(d)	Other Decentralized systems (Stakeholders, WUAs, etc.)	.....	.....

2.5.5. Efficiency and extensiveness of water transfers (in your learned judgement) *(on a 0 to 10 scale)*

		Inter-regional Transfers	*Inter-sectoral Transfers*
(a)	How extensive are they?		
(i)	Macro level	.....	.....
(ii)	Micro level	.....	.....
(b)	How smooth are they?		
(i)	Macro level	.....	.....
(ii)	Micro level	.....	.....

2.6 Other Policies Affecting Water Development/Use

2.6.1 Please indicate (*Tick*) and evaluate (*on a 0 to 10 scale*) the effects of other policies affecting water development/use.

		Tick	*(0 to 10)*
(a)	Agricultural policies	.....	.....
(b)	Energy/power policies	.....	.....
(c)	Soil Conservation policies	.....	.....
(d)	Pollution control/environmental policies	.....	.....
(e)	Fiscal policies (structural adjustment)	.....	.....
(f)	Credit/investment policies	.....	.....
(g)	Foreign investment/aid policies	.....	.....
(h)	Others, specify (e.g., trade policies)		
	.....	.....	.....

2.7 Privatization and Decentralization Tendencies

2.7.1 Are government policies favorable for private sector participation in water sector? Yes/No

2.7.2 If yes, how favorable are those policies *(on a 0 to 10 scale)*?

(a)	Irrigation	.....
(b)	Urban domestic use	.....
(c)	Rural domestic use	.....
(d)	Industrial/commercial use	.....

2.7.3 How extensive is private sector participation *(on a 0 to 10 scale)?*

(a)	Irrigation	.....
(b)	Urban domestic use	.....
(c)	Rural domestic use	.....
(d)	Industrial/commercial/use	.....

2.7.4 In your opinion, how well are users disposed towards private sector involvement in water sector *(Tick one)*?

(a)	Favorable overall	.....
(b)	Favorable in particular sector	.....
(c)	Not favorable	.....
(d)	Indifferent	.....
(e)	Opposed	.....

2.7.5 Are government policies favorable for users participation and decentralization? Yes/No

2.7.6 If yes, how favorable are these policies *(on a 0 to 10 scale)*?

		Planning	*Development*	*Management*
(a)	Irrigation	.....	.....	.....
(b)	Urban domestic use	.....	.....	.....
(c)	Rural domestic use	.....	.....	.....
(d)	Industrial/commercial/use	.....	.....	.....

2.7.7 How extensive is users participation *(on a 0 to 10 scale)*?

		Planning	*Development*	*Management*
(a)	Irrigation	.....	.....	.....
(b)	Urban domestic use	.....	.....	.....
(c)	Rural domestic use	.....	.....	.....
(d)	Industrial/commercial use	.....	.....	.....

2.7.8 In your opinion, how well are government officials disposed towards users participation and decentralization *(Tick one)*?

		User Participation	*Decentralization*
(a)	Favorable overall	.....	.....
(b)	Favorable in selective contexts.....		.....
(c)	Not favorable	.....	.....
(d)	Indifferent	.....	.....
(e)	Opposed	.....	.....

2.7.9 How effective are NGO (users, private corporate sector, and foreign funding and technical agencies) participation in water sector *(on a 0 to 10 scale)*?

	Resource Development			*Distribution*	*Management*
	Planning	*Finance*	*Execution.*		
I. Irrigation					
(a) User Groups	.....	.....	.....	.....	.....
(b) Private sector	.....	.....	.....	.....	.....
(c) Foreign Aid/ Funding Agency	.....	.....	.....	.....	.....
(d) Foreign private technical firms	.....	.....	.....	.....	.....

	Resource Development			*Distribution*	*Management*
	Planning	*Finance*	*Execution.*		
II Domestic Use					
(a) User Groups	.....	.....	.....	.....	.....
(b) Private sector	.....	.....	.....	.....	.....
(c) Foreign Aid/ Funding Agency	.....	.....	.....	.....	.....
(d) Foreign private technical firms	.....	.....	.....	.....	.....

2.8. Policies Towards Water Technologies/Extension/Recycling

2.8.1. In your learned judgement, how effective are these policies *(on a 0 to 10 scale)*?

(a) Water technology policies

(i) Measuring devices .....
(ii) Recycling technologies .....
(iii) Drip systems .....
(iv) Sprinkler systems .....
(v) Any other, specify
....

(b) Water technology policies

(i) Water saving methods .....
(ii) Climate/rain forecasts .....
(iii) Drought resistant crops and farming practices .....
(iv) Water quality/sanitation .....
(v) Any other, specify
....

(c) Water technology policies

(i)	Regulatory policies	.....
(ii)	Incentives policies	.....
(iii)	Research/extension/education	.....
(iv)	Any other, specify	
	.....	.....

(d) Technological application policies

(i)	Satellites/Remote sensing	.....
(ii)	Computers	.....
(iii)	Geographical information system	.....
(iv)	Management information system	.....
(v)	Any other, specify	
	.....	.....

2.9 Linkage Between Water Law and Water Policy

2.9.1 In your opinion, how well water policy reflects water law *(on a 0 to scale)*? .....

3. WATER ADMINISTRATION

3.1 Government Branches and Departments Influencing Water Sector

3.1.1 Indicate your judgement on the relative role and influence of government branches on water sector *(on a 0 to 10 scale or percentages)*

	Irrigation	*Domestic Use*	*Industrial Use*
(a) Central/Federal Govt.	.....	.....	.....
(b) State/Regional Govt.	.....	.....	.....
(c) Local Govt. (Municipalities countries, precincts, etc.)	.....	.....	.....
(d) Statutory Bodies/Authorities	.....	.....	.....

3.1.2 Is there an exclusive department for water or the responsibility is dispersed? Yes/No

3.1.3 If dispersed, indicate your judgmental weights on the selective role of government departments influencing water sector *(on a 0 to 10 scale or percentage).*

(a) Water Resources/Irrigation Department .....
(b) Agricultural Department .....
(c) Environment and Forest Department .....
(d) Urban/Local Admin. Dept. .....
(e) Legal Department .....
(f) Others, specify
(e.g., Economic Affairs/finance) .....

3.1.4 To what extent administrative co-ordination is achieved?
(on 0 to 10 scale) .....

3.1.5 Is there a specialized agency for different sub-sectors? Yes/No

3.16 If yes, name the agency for each sub-sector:

Surface water .....
Groundwater .....
Water Quality .....
Recycling .....
Irrigation .....
Urban Use .....
Rural Use .....
Hydro Power .....

3.1.7 If there is no exclusive Department for water sector or specialized agencies for different sub-sector, indicate your judgmental value as to how this lacuna deter better water administration *(on a 0 to 10 scale)* .....

3.2. Organizational Basis and Structure of Water Administration

3.2.1. How the water administration is organized *(Tick)*

(a) On administrative division (mere geographical basis) .....
(b) On Hydro-geological regions .....
(c) River Basins .....
(d) Mixture of all .....

3.2.2 In your opinion, how strong is the capacity on the following functional spheres *(on a 0 to 10 scale)*?

(a) Planning and design .....
(b) Implementation .....
(c) Financial Management .....
(d) Operation and maintenance .....
(e) Rehabilitation and resettlement .....
(f) Environmental monitoring .....
(g) Research and training .....
(h) Extension/education .....
(I) Inter-agency/dept. relationships .....
(j) Others, specify (e.g., public relations/accountability) .....

3.2.3 In your judgement, does the water administration have a balanced functional specialization? Yes/No

3.2.4 If no, what are the gaps in the existing administrative set-up (Please list them with its *priority ranking*)?

(a) ....
(b) ....
(c) ....
(d) ....
(e) ....

3.3 Financing and Staffing Pattern

3.3.1 Do you feel that the water administration budget is adequate to meet its modernization and strengthening objectives? Yes/No

3.3.2 If yes, how serious is the budget constraint *(on a 0 to 10 scale)*? .....

3.3.3 Is the water administration overstaffed? Yes/No

3.3.4 If yes, how strong is the scope for staff reduction *(on a 0 to 10 scale)*? .....

3.3.5 Can privatization and community participation reduce redundancy in water administration? Yes/No

3.3.6 If yes, how strong is the staff reduction effect *(on a 0 to 10 scale)*

(a) Privatization .....
(b) User participation .....

3.3.7 If no, do you think privatization and users participation is a complement but not substitutes in staffing context? Yes/No

3.4. Water Pricing and Fee Collection Bodies

3.4.1. Is there an independent body for determining water price Yes/No

3.4.1.1. If yes, state the name of the body and its relationship with water administration

(a) Name .....
(b) Its Administrative Relationship .....
.....

3.4.1.2. If no, what are the agencies involved in price determination (please list them for various water uses like irrigation, urban and rural domestic use, etc. separately).

3.4.2. Are the price determination and fee collection functions in the same agency? Yes/No

3.4.3. If no, which agency performs fee collection?

3.5. Regulatory and Accountability Mechanisms

3.5.1. What are the regulatory mechanisms and how effective are they at the implementation stage

	Mechanisms *(Tick)*	Effectiveness *(on a 0 to 10 Scale)*
(a) Legal Regulations	.....	.....
(b) Administrative directions	.....	.....
(c) Pollution control agencies	.....	.....
(d) River Boards	.....	.....
(e) Basin Organizations	.....	.....
(f) Groundwater Regulations		
(i) Depth Restrictions	.....	.....
(ii) Spacing regulations	.....	.....
(g) Withdrawal restrictions (Water rights, quota)	.....	.....
(h) Limits on moving water across regions (surface water)	.....	.....
(i) Any other, specify	.....	.....

3.5.2. In what way, the legal provisions of accountability is administratively (or organizationally) translated and how effective are they in practice?

		(Tick)	*(on a 0 to 10 scale)*
(a)	**Within formal water administration**		
(i)	Administrative Supervision	.....	.....
(ii)	Financial Auditing (Public Accounts Committees)	.....	.....
(iii)	Work Auditing	.....	.....
(iv)	Grievance cells	.....	.....
(v)	Monitoring procedure for sectoral/regional water allocation	.....	.....
(vi)	Inter-ministerial committees	.....	.....
(vii)	Any other, specify	.....	.....
(b)	**Outside Formal Water Administration**		
(i)	Local User Groups	.....	.....
(ii)	NGOs	.....	.....
(iii)	Local Administration (Govt.)	.....	.....
(iv)	Any other, specify (statutory Bodies)	.....	.....

3.6. Information Basis of Water Sector

3.6.1. Is there a separate wing within water administration for water sector data collection/updating/maintenance? Yes/No

3.6.1.1. If yes, please state the name of the agency

3.6.1.2. If no, which other agency or agencies maintain water data *(Please list them)*

3.6.2. Are water data published regularly? Yes/No

3.6.3. Are water data computerized? Yes/No

3.6.4. In you opinion, how adequate and reliable are water sector data for planning purpose *(or a 0 to 10 scale)*

(a) Adequacy .....
(b) Reliability .....

3.6.5. How strong the information flow between irrigation/water department and water and land research institutes/experiment stations/universities *(on a 0 to 10 scale)*?

(a) Research Institutes .....
(b) Experiment Stations .....
(c) Universities/experts .....

3.6.7. How strong the influence of water administration (or irrigation/water department) in determining the research agenda of the research institutes/experiment stations/universities/experts *(on a 0 to 10 scale)*

(a) Research Institutes .....
(b) Experiment Stations .....
(c) Universities/experts .....

3.6.8. Do you feel the ongoing research adequately address the emerging issues in the water sector *(on a 0 to 10 scale)* .....

3.7. Use of Science and Technology in Water Administration

3.7.1. Please judge the extent of the use of the following science/technology components *(on a 0 to 10 scale)*

(a)	Computers	.....
(b)	Remote sensing and satellite	.....
(c)	Research/experimental information	.....
(d)	Modern accounting/auditing techniques	.....
(e)	management information system	.....
(f)	Geographic information system	.....
(g)	Wireless communication	.....
(h)	Water measuring technology	.....
(i)	Computerized dynamic regulation of canal/water delivery networks	.....
(j)	Any other, specify	.....

3.8. Overall Evaluation

3.8.1. How strong is the administrative and technical linkages between water administration and research institutes/ experiment stations/universities *(on a 0 to 10 scale)* .....

3.8.2. How adequate is the administrative set up to operationalize the water policy and water law *(on a 0 to 10 scale)?* .....

3.8.3. Do you feel that the extension/education wing of the water administration is weak/ineffective? Yes/No

4. WATER SECTOR PERFORMANCE: OVERALL SUBJECTIVE EVALUATION

NB: *This section tries to enlist your overall **subjective perception on few key components of overall water sector (covering all sub-sectors) performance.** Please feel free to place a number in the 0 to 10 scale (0 being the least and 10 being the best) that represents best your subjective judgement.*

4.1. Physical Performance *(on a 0 to 10 scale)*

(a) Ability to bridge overall demand-supply .....
(b) Physical Health of Water Infrastructure .....
(c) Conflict resolution efficiency (low-cost and less time) .....
(d) Smoothness of water transfers across sectors/regions .....
(e) Smoothness of water transfers among users
.....

4.2. Financial Performance *(on a 0 to 10 scale)*

(a) Actual investment vs. investment requirements .....
(b) Cost recovery vs. expenditure .....

4.3. Economic Efficiency *(on a 1 to 10 scale)*

(a) Extent water prices cover supply cost .....
(b) Extent water prices cover scarcity value .....

4.4. Equity Performance *(on 0 to 10 scale)*

(a) Equity between regions .....
(c) Equity between sectors .....
(d) Equity among social groups
.....

4.5. Progressiveness of Water Institution *(on 0 to 10 scale)* .....
(Key Considerations here include factors such as adaptive capacity, scope for innovation, openness for change, and and ability to handle future water challenges).

APPENDIX-C: THE DATA SET

Table C.1. Survey Data on Legal Variables.

Basic Details				Legal Treatment of Water			Forms of Rights in Water Sources & Quality					Conflict Resolution	
SL	CID	RID	EXP	LTRWSA	LTRWSD	LLIBWO	LPRLRF	LPRSRF	LPRGRF	LPRQRF	LPRORE	LCRMEF	LCRMEE
1	AU	1	2	1	3	7.33	3	6	2	4	5.00	4	6.67
2	AU	2	2	0	3	6.67	2	2	2	2	4.00	7	4.00
3	AU	3	1	0	4	7.33	3	5	5	2	5.00	9	6.00
4	BR	1	2	0	2	6.33	3	1	2	2	1.00	2	3.00
5	BR	2	2	0	3	9.00	1	4	3	1	6.00	2	7.33
6	BR	3	2	0	2	5.67	1	2	2	2	5.00	7	8.00
7	BR	4	1	0	3	8.67	1	2	2	2	7.00	2	5.33
8	CL	1	2	0	1	1.00	3	1	1	3	5.00	3	1.67
9	CL	2	4	1	0	4.00	3	4	1	1	3.00	8	5.33
10	CL	3	1	0	0	1.00	2	4	3	0	0.00	8	6.67
11	CL	4	2	1	1	1.00	2	4	3	2	4.00	8	2.67
12	CL	5	1	0	1	1.67	3	5	3	1	4.00	6	4.33
13	CN	1	2	1	1	8.00	0	2	2	2	4.00	2	6.67
14	CN	2	3	0	3	5.33	2	2	2	2	5.00	7	4.00
15	CN	3	2	0	3	5.00	0	2	2	1	5.00	4	4.67
16	IN	1	4	0	2	5.67	0	2	2	3	2.00	8	2.00
17	IN	2	1	0	2	5.00	0	2	0	2	3.00	1	6.33
18	IN	3	1	0	3	7.67	0	3	1	3	3.00	6	2.33
19	IN	4	1	0	3	4.55	0	2	3	2	5.00	3	3.33
20	IN	5	2	0	4	7.00	0	2	2	3	5.00	9	7.33
21	IS	1	1	1	1	1.00	0	0	2	2	10.00	3	0.00
22	IS	2	1	1	0	0.67	0	0	2	2	5.00	2	5.67
23	IS	3	2	1	1	3.00	0	0	2	2	6.00	1	7.33
24	IS	4	3	1	3	7.00	0	0	4	2	8.00	2	7.67
25	MX	1	1	1	4	5.50	1	2	2	2	2.00	8	5.67
26	MX	2	2	0	2	1.67	3	2	2	2	1.00	8	10.00
27	MX	3	2	1	0	4.33	3	4	3	2	4.00	7	6.00
28	MX	4	1	1	3	7.67	1	2	2	2	8.00	7	6.00
29	MX	5	2	0	4	8.33	1	2	2	2	6.00	2	5.67
30	MX	6	2	0	2	8.00	2	1	1	2	5.00	8	10.00
31	SA	1	2	0	3	5.00	3	3	1	2	5.00	1	7.00
32	SA	2	2	0	2	3.33	3	3	1	2	6.00	1	3.33
33	SP	1	1	0	4	9.00	3	5	1	2	2.00	8	6.67
34	SP	2	2	1	3	7.00	3	2	2	3	3.00	3	6.67
35	SP	3	3	1	2	2.33	3	1	1	2	9.00	3	4.00
36	SP	4	1	1	2	7.00	3	2	2	2	5.00	7	5.67
37	SP	5	1	1	3	7.67	4	2	2	2	7.50	9	5.00
38	SL	1	1	0	2	6.00	0	5	2	3	5.00	0	0.33
39	SL	2	1	0	0	1.00	0	0	1		1.00	0	1.67
40	SL	3	1	0	1	8.67	2	0	1	2	1.00	0	0.33
41	CO	1	2	1	2	8.67	3	4	2	1	7.00	0	6.67
42	CO	2	3	1	1	4.67	3	4	3	1	6.00	5	2.33
43	IL	1	2	1	2	2.33	3	3	1	2	4.00	0	0.00

Note: In this and all subsequent tables in this section the first four variables (SL, CID, RID, and EXP) are respectively the serial number, country identification number, respondents identification number, and filed of expertise. The codes for the field of expertise are: 1 for economist, 2 for engineers, 3 for lawyers, and 4 for others (hydro-geologists, social scientists, etc.). For other variables, see the variable definition in the main body of the report.

Table C.1. Survey Data on Legal Variables (Cont'd).

Basic Details				Accountability		Inter-govtl. Responsibility	Overall Judgmental Evaluation			
SL	CID	RID	EXP	LACPRF	LACPRE	LIGRES	LINTRE	LOECEN	LOEPRV	LOEFWL
1	AU	1	2	4.00	5.00	0.00	5.00	6.00	5.00	7.60
2	AU	2	2	1.00	7.00	4.00	8.00	7.00	8.00	5.60
3	AU	3	1	1.00	4.00	3.00	7.00	6.00	8.33	6.40
4	BR	1	2	0.50	3.00	1.60	8.00	2.00	10.00	6.00
5	BR	2	2	2.00	7.50	3.00	8.00	3.00	8.67	8.00
6	BR	3	2	0.00	0.00	2.00	0.00	5.00	6.33	6.40
7	BR	4	1	2.50	3.00	1.80	4.00	2.00	5.00	6.00
8	CL	1	2	1.50	5.00	1.00	0.00	8.00	4.00	1.00
9	CL	2	4	1.50	4.50	2.20	0.00	2.00	8.00	6.00
10	CL	3	1	3.00	5.00	1.20	0.00	3.00	10.00	8.40
11	CL	4	2	2.50	7.00	1.00	0.00	5.00	5.33	6.20
12	CL	5	1	1.50	5.00	1.00	4.00	4.00	5.00	4.40
13	CN	1	2	2.00	5.50	1.40	8.00	6.00	1.67	5.00
14	CN	2	3	2.00	5.00	1.00	0.00	5.00	5.00	6.00
15	CN	3	2	1.50	8.50	2.40	5.00	7.00	8.00	5.60
16	IN	1	4	-1.00	1.00	2.00	3.00	9.00	1.00	2.00
17	IN	2	1	1.50	3.50	2.00	2.00	8.00	4.00	2.80
18	IN	3	1	0.50	1.50	2.00	2.00	6.00	2.33	3.80
19	IN	4	1	1.00	1.50	2.00	2.00	5.00	3.00	3.00
20	IN	5	2	0.00	0.00	3.00	2.00	4.00	4.67	5.40
21	IS	1	1	0.50	4.00	1.00	8.00	7.00	0.00	7.00
22	IS	2	1	0.00	0.00	2.20	4.00	2.00	3.67	4.60
23	IS	3	2	2.00	8.00	1.80	8.00	8.00	4.33	8.00
24	IS	4	3	2.00	5.50	2.20	9.00	8.00	6.00	7.00
25	MX	1	1	2.50	4.50	2.00	2.00	9.00	2.00	2.00
26	MX	2	2	2.50	6.00	1.20	7.00	10.00	8.50	6.60
27	MX	3	2	2.50	6.50	1.00	0.00	5.00	8.00	6.20
28	MX	4	1	3.00	6.50	1.60	6.00	10.00	4.67	5.40
29	MX	5	2	3.00	5.50	1.80	0.00	10.00	6.00	6.80
30	MX	6	2	3.00	9.00	1.00	7.00	0.00	10.00	9.80
31	SA	1	2	2.50	5.00	2.60	5.00	8.00	4.33	6.20
32	SA	2	2	0.00	2.00	3.80	8.00	9.00	1.67	3.50
33	SP	1	1	2.00	4.50	3.40	3.00	0.00	6.33	4.80
34	SP	2	2	2.00	4.00	2.20	0.00	3.00	5.00	6.20
35	SP	3	3	1.00	7.50	2.20	0.00	7.00	7.33	4.80
36	SP	4	1	2.00	5.00	2.00	9.00	5.00	9.00	7.75
37	SP	5	1	3.00	5.50	2.00	6.00	2.00	1.00	6.00
38	SL	1	1	-1.00	2.00	2.00	3.00	8.00	3.67	4.20
39	SL	2	1	-1.00	0.00	0.60	2.00	8.00	3.33	1.60
40	SL	3	1	1.00	10.00	2.60	3.00	0.00	10.00	1.00
41	US	1	2	2.00	9.00	4.00	0.00	4.00	8.67	6.80
42	US	2	3	2.00	6.50	3.80	0.00	2.00	4.00	5.20
43	US	3	2	1.50	4.00	3.20	4.00	6.00	5.00	5.00

Table C.2. Survey Data on Policy Variables.

Basic Details				Project Selection	Pricing and Cost Recovery		Inter-Regional/Sectoral Water Transfer Policy				
SL	CID	RID	EXP	PPSCRI	PPRREV	PCOREC	PIRSWT	PIRSWR	PIRSWM	PIRSWO	PIRSWE
1	AU	1	2	6.00	3.25	3.00	1	4	5	1	8.00
2	AU	2	2	6.00	3.00	3.25	1	4	5	1	5.25
3	AU	3	1	6.00	3.00	2.75	1	4	3	2	6.75
4	BR	1	2	4.00	0.00	0.50	1	1	1	2	4.00
5	BR	2	2	4.00	1.75	1.75	1	1	3	1	2.50
6	BR	3	2	4.00	2.00	2.00	1	3	1	2	0.00
7	BR	4	1	2.00	1.50	2.00	1	3	1	2	0.00
8	CL	1	2	4.33	2.75	2.50	1	4	5	1	3.75
9	CL	2	4	1.00	3.25	3.00	1	4	5	1	0.75
10	CL	3	1	0.33	1.00	0.75	1	4	0	1	5.25
11	CL	4	2	1.33	2.25	1.75	1	4	5	1	5.00
12	CL	5	1	1.00	2.50	0.00	1	4	0	1	6.25
13	CN	1	2	4.00	2.75	2.75	1	3	1	2	6.25
14	CN	2	3	5.00	2.00	2.00	1	4	2	2	0.00
15	CN	3	2	5.00	1.75	2.00	1	3	2	3	6.25
16	IN	1	4	3.00	2.25	0.75	1	2	5	2	5.13
17	IN	2	1	5.00	1.75	2.00	1	3	2	1	2.50
18	IN	3	1	3.00	1.75	1.25	1	2	3	1	2.50
19	IN	4	1	2.00	1.50	2.00	1	2	2	4	3.00
20	IN	5	2	6.00	2.25	2.00	1	1	1	1	1.00
21	IS	1	1	4.00	3.25	3.00	1	3	2	1	0.00
22	IS	2	1	1.33	3.25	3.25	1	3	2	1	2.50
23	IS	3	2	0.67	3.25	3.00	1	2	1	1	7.50
24	IS	4	3	3.00	3.25	2.50	1	3	1	1	7.50
25	MX	1	1	1.00	3.25	3.25	1	3	5	1	0.00
26	MX	2	2	5.00	3.25	1.50	1	3	4	3	7.75
27	MX	3	2	5.00	2.75	2.50	1	3	1	2	3.75
28	MX	4	1	4.67	2.50	2.50	1	3	1	1	3.50
29	MX	5	2	2.67	2.00	2.00	1	3	1	1	2.38
30	MX	6	2	3.67	3.25	2.50	1	3	4	3	8.75
31	SA	1	2	4.00	3.00	2.50	1	3	4	3	4.00
32	SA	2	2	3.00	2.75	3.00	1	2	1	3	3.25
33	SP	1	1	4.00	2.25	2.75	1	4	1	1	0.75
34	SP	2	2	0.67	1.75	2.00	1	1	4	1	0.75
35	SP	3	3	1.33	2.00	2.25	1	4	1	3	2.50
36	SP	4	1	2.33	2.25	2.50	1	3	4	1	4.50
37	SP	5	1	6.00	2.67	2.00	1	4	1	2	3.00
38	SL	1	1	4.00	1.25	1.00	1	3	1	1	6.50
39	SL	2	1	5.00	1.75	2.00	0	0	0	0	0.00
40	SL	3	1	3.33	0.25	1.50	0	0	0	0	0.00
41	US	1	2	3.67	2.00	2.00	1	3	3	1	5.50
42	US	2	3	4.00	3.25	3.25	1	1	3	1	3.00
43	US	3	2	3.67	1.00	1.50	0	0	0	0	0.00

Table C.2. Survey Data on Policy Variables (Cont'd).

Basic Details				Privatization Policy				User Participation Policy			
SL	CID	RID	EXP	PGPTPP	PGPIPP	PEXTPP	PUATPP	PGPTUP	PGPIUP	PEXTUP	POATUP
1	AU	1	2	1	8.00	8.00	5.00	1	8.00	5.17	5.00
2	AU	2	2	1	5.25	5.25	4.00	1	0.00	3.08	5.00
3	AU	3	1	1	7.50	6.75	4.00	1	2.42	2.25	5.00
4	BR	1	2	1	8.00	3.50	5.00	1	0.00	4.00	3.50
5	BR	2	2	1	0.75	4.00	4.00	1	4.25	4.25	4.00
6	BR	3	2	1	0.00	5.00	4.00	1	4.75	2.92	4.50
7	BR	4	1	1	0.00	1.50	4.00	1	5.33	2.00	4.00
8	CL	1	2	1	1.00	7.50	5.00	1	7.50	6.67	5.00
9	CL	2	4	1	10.00	10.00	5.00	1	10.00	10.00	5.00
10	CL	3	1	1	2.50	2.25	5.00	1	1.83	1.25	5.00
11	CL	4	2	1	7.50	5.75	4.00	1	6.50	5.50	4.00
12	CL	5	1	1	6.75	5.75	5.00	1	4.33	4.25	4.50
13	CN	1	2	1	0.00	1.00	3.00	1	0.00	1.58	3.50
14	CN	2	3	1	3.00	3.00	5.00	1	0.42	0.83	2.00
15	CN	3	2	1	0.00	4.00	5.00	1	0.00	6.67	4.00
16	IN	1	4	1	1.00	1.50	2.00	1	0.92	0.83	4.00
17	IN	2	1	1	1.00	2.25	4.00	1	2.92	3.08	3.00
18	IN	3	1	1	4.00	2.25	4.00	1	0.58	1.67	4.00
19	IN	4	1	1	2.00	3.00	3.00	1	1.75	2.00	4.00
20	IN	5	2	1	0.00	0.00	5.00	1	4.83	5.58	3.50
21	IS	1	1	1	0.00	0.00	0.00	0	0.00	0.00	0.00
22	IS	2	1	1	5.25	5.50	4.00	1	2.83	0.00	4.00
23	IS	3	2	1	7.75	5.50	5.00	1	7.00	1.83	2.00
24	IS	4	3	1	5.75	5.75	4.00	1	3.25	3.58	3.50
25	MX	1	1	1	6.75	4.00	5.00	1	3.67	1.75	4.00
26	MX	2	2	1	10.00	7.25	5.00	1	6.00	6.00	5.00
27	MX	3	2	1	7.50	5.75	4.00	1	4.75	5.17	4.00
28	MX	4	1	1	5.75	0.63	4.00	0	0.00	3.83	1.00
29	MX	5	2	1	5.00	1.25	3.00	1	5.00	6.33	3.50
30	MX	6	2	1	2.50	8.00	5.00	1	9.25	6.67	4.50
31	SA	1	2	1	7.00	2.25	4.00	1	6.17	2.58	4.00
32	SA	2	2	1	3.50	1.25	2.00	1	5.00	2.50	5.00
33	SP	1	1	1	5.50	3.00	3.00	1	6.33	4.17	4.00
34	SP	2	2	1	6.00	6.00	4.00	1	6.83	5.83	3.50
35	SP	3	3	1	10.00	6.50	4.00	1	3.75	3.25	4.00
36	SP	4	1	1	0.00	0.00	4.00	1	7.50	7.50	5.00
37	SP	5	1	1	5.50	2.00	4.00	1	2.89	2.22	4.00
38	SL	1	1	0	0.00	0.00	2.00	1	3.75	2.92	5.00
39	SL	2	1	0	0.00	2.25	2.00	1	3.50	3.58	3.00
40	SL	3	1	0	0.00	2.00	3.00	1	1.00	1.00	4.00
41	US	1	2	1	6.50	5.00	5.00	1	5.42	4.92	4.00
42	Us	2	3	1	8.25	5.25	5.00	1	7.42	6.42	5.00
43	Us	3	2	1	3.75	4.00	2.00	0	0.00	0.00	0.00

Table C.2. Survey Data on Policy Variables (Cont'd).

Basic Details				NGO Participation Policy					Effects of Other Policies		Overall Evaluation	
SL	CID	RID	EXP	PNGOOP	PNGOUG	PNGOPS	PNGOFA	PNGOFP	POPAWN	POPAWE	POELWL	POEFWP
1	AU	1	2	6.42	2.80	2.90	0.00	2.00	8	6.00	8.00	7.22
2	AU	2	2	5.60	2.80	2.80	0.00	0.00	4	4.50	8.00	6.62
3	AU	3	1	6.27	3.00	3.00	0.00	0.90	7	7.50	8.00	6.77
4	BR	1	2	4.53	4.10	5.30	7.00	1.70	3	7.14	9.00	5.43
5	BR	2	2	0.00	0.00	0.00	0.00	0.00	7	9.00	7.00	8.33
6	BR	3	2	0.00	0.00	0.00	0.00	0.00	3	6.33	9.00	7.00
7	BR	4	1	0.30	0.00	0.00	1.20	0.00	3	5.14	5.00	6.33
8	CL	1	2	4.20	3.50	6.00	0.50	0.50	3	6.33	9.00	5.80
9	CL	2	4	1.00	0.50	0.50	0.50	0.50	4	2.50	6.00	7.00
10	CL	3	1	5.56	3.50	1.30	0.20	0.00	5	4.67	7.00	8.22
11	CL	4	2	4.14	3.60	5.60	0.70	1.70	7	6.00	8.00	5.20
12	CL	5	1	4.58	6.00	6.10	4.00	2.20	6	4.80	6.00	4.33
13	CN	1	2	5.00	0.00	0.00	1.00	0.50	7	5.43	6.00	7.07
14	CN	2	3	1.39	0.70	0.60	0.60	0.60	4	5.33	5.00	3.42
15	CN	3	2	8.60	4.20	0.00	4.40	0.00	3	3.88	9.00	6.67
16	IN	1	4	4.00	2.00	0.00	1.20	0.00	6	4.50	3.00	2.46
17	IN	2	1	2.80	1.40	1.10	1.50	1.60	4	6.86	4.00	3.87
18	IN	3	1	2.38	3.80	2.10	2.20	1.40	7	6.83	1.00	2.00
19	IN	4	1	1.75	3.00	2.00	1.00	1.00	7	5.00	4.00	4.50
20	IN	5	2	4.45	4.50	2.90	5.80	4.60	7	7.71	10.00	5.67
21	IS	1	1	0.40	0.04	0.00	0.00	0.00	5	6.00	7.00	8.67
22	IS	2	1	2.20	1.10	0.00	0.00	0.00	5	4.33	2.00	3.29
23	IS	3	2	6.50	3.50	3.00	0.00	0.00	7	2.13	8.00	8.14
24	IS	4	3	5.80	3.30	2.50	0.00	0.00	7	7.00	7.00	8.40
25	MX	1	1	5.80	1.60	1.30	0.00	0.00	2	7.29	3.00	2.53
26	MX	2	2	1.90	2.50	3.50	1.60	0.00	4	5.13	8.00	3.13
27	MX	3	2	6.50	1.70	6.10	0.00	0.00	4	6.00	7.00	5.20
28	MX	4	1	2.30	3.10	2.50	1.20	2.40	3	6.75	8.00	5.94
29	MX	5	2	4.20	1.00	3.20	1.20	0.90	2	7.75	7.00	6.06
30	MX	6	2	5.93	6.10	7.80	7.20	2.60	4	7.14	8.00	7.13
31	SA	1	2	7.45	4.90	10.00	0.00	0.00	8	1.75	8.00	4.07
32	SA	2	2	1.12	1.40	1.10	1.00	1.00	7	5.00	8.00	5.13
33	SP	1	1	6.67	5.70	7.20	0.00	7.10	7	3.00	8.00	7.07
34	SP	2	2	4.50	6.40	4.70	5.80	1.10	2	6.00	5.00	6.73
35	SP	3	3	7.00	2.10	3.90	5.10	5.70	4	4.71	8.00	4.66
36	SP	4	1	8.00	4.70	5.10	0.00	1.40	5	6.33	8.00	5.93
37	SP	5	1	1.30	1.90	1.30	0.90	1.10	6	5.60	8.00	4.56
38	SL	1	1	3.70	2.40	0.40	3.00	1.60	2	8.00	5.00	2.47
39	SL	2	1	2.67	3.90	1.60	2.20	2.70	3	5.40	1.00	1.25
40	SL	3	1	6.20	8.00	2.50	5.00	0.00	3	1.50	7.00	2.10
41	US	1	2	2.50	0.00	1.00	0.00	0.00	4	6.00	8.00	4.10
42	US	2	3	1.85	4.10	3.30	0.00	0.00	3	5.00	9.00	6.00
43	US	3	2	0.00	0.00	0.00	0.00	0.00	7	8.50	8.00	6.36

Table C.3. Survey Data on Administrative Variables.

Basic Details				Influence of Government Layers				Organizational Features				
SL	CID	RID	EXP	AGBIWN	AGBIWR	AGBIWL	AGBIWS	AEXCLD	ADOMID	AACORD	ASADSS	AORGBA
1	AU	1	2	2.00	10.00	5.33	4.67	1	9.00	8.00	1	2
2	AU	2	2	4.00	7.67	4.67	7.33	1	8.00	5.00	1	4
3	AU	3	1	4.67	5.33	4.00	3.33	1	9.00	8.00	1	3
4	BR	1	2	7.33	6.33	7.33	3.00	1	8.00	3.00	1	4
5	BR	2	2	5.00	5.00	3.33	0.00	1	7.00	6.00	1	2
6	BR	3	2	7.00	8.67	7.67	0.00	0	9.00	0.00	1	3
7	BR	4	1	4.00	6.00	3.33	4.67	1	0.00	4.00	0	4
8	CL	1	2	7.00	0.00	3.00	5.33	1	10.00	5.00	1	1
9	CL	2	4	6.00	6.00	0.00	0.00	1	0.00	6.00	0	1
10	CL	3	1	3.33	1.67	0.67	0.00	1	10.00	6.00	1	1
11	CL	4	2	0.00	0.00	0.00	0.00	1	9.00	7.00	0	1
12	CL	5	1	3.33	3.67	3.00	2.00	1	7.00	4.00	0	2
13	CN	1	2	10.00	8.00	9.00	6.00	0	10.00	6.00	0	4
14	CN	2	3	4.67	5.33	5.00	0.00	1	7.00	5.00	0	4
15	CN	3	2	7.00	8.00	9.00	0.00	1	8.00	4.00	1	4
16	IN	1	4	1.33	3.67	1.00	2.67	0	8.00	4.00	1	1
17	IN	2	1	2.33	6.50	1.00	5.33	0	7.00	5.00	1	2
18	IN	3	1	3.33	3.33	1.67	4.00	1	7.00	2.00	1	1
19	IN	4	1	2.50	6.00	1.00	2.00	0	8.00	6.00	1	1
20	IN	5	2	5.00	8.67	8.67	8.67	1	7.00	5.00	1	1
21	IS	1	1	9.00	3.33	1.00	0.00	1	0.00	0.00	0	1
22	IS	2	1	6.33	3.33	1.67	0.00	1	0.00	0.00	0	1
23	IS	3	2	5.67	4.00	3.50	0.00	1	0.00	7.00	0	1
24	IS	4	3	9.33	5.00	5.00	4.67	1	0.00	0.00	0	1
25	MX	1	1	7.33	4.33	3.00	4.00	1	0.00	2.00	1	4
26	MX	2	2	6.33	7.00	4.67	10.00	1	7.00	10.00	0	2
27	MX	3	2	6.67	5.67	0.00	0.00	1	0.00	0.00	0	4
28	MX	4	1	3.67	3.33	4.67	5.33	1	3.00	7.00	0	3
29	MX	5	2	5.00	2.67	3.67	5.33	0	5.00	7.00	0	4
30	MX	6	2	8.00	8.67	7.33	2.00	1	0.00	0.00	0	2
31	SA	1	2	8.00	2.33	3.33	3.67	1	7.00	5.00	1	2
32	SA	2	2	3.67	5.33	4.33	3.00	1	9.00	6.00	1	2
33	SP	1	1	3.67	5.67	6.33	2.00	1	3.00	3.00	0	4
34	SP	2	2	6.00	7.33	6.00	8.67	1	8.00	5.00	0	4
35	SP	3	3	4.33	3.67	4.67	0.00	1	0.00	0.00	0	3
36	SP	4	1	5.00	2.33	2.67	0.00	0	6.50	0.00	1	4
37	SP	5	1	2.00	2.00	2.67	0.00	1	6.00	3.00	1	2
38	SL	1	1	8.33	7.33	6.33	2.67	0	0.00	5.00	1	2
39	SL	2	1	3.33	2.67	2.67	6.00	1	8.00	3.00	1	1
40	SL	3	1	3.33	3.33	1.67	1.67	1	2.00	5.00	0	2
41	CO	1	2	4.33	6.00	3.67	0.00	1	0.00	0.00	0	3
42	CO	2	3	6.33	8.00	2.00	5.00	1	9.00	8.00	0	4
43	IL	1	2	5.33	6.00	6.67	2.00	0	9.00	8.00	1	1

Table C.3. Survey Data on Administrative Variables (Cont'd).

Basic Details				Functional Capacity			Pricing and Finance			Regulation Capacity	
SL	CID	RID	EXP	AOFCAP	ABALFS	ASREPU	AIBDWP	APFCSA	ASBUDC	AREGMN	AREGME
1	AU	1	2	8.00	1	8.00	1	0	8.00	9	8.00
2	AU	2	2	6.50	1	7.00	1	0	6.00	9	6.56
3	AU	3	1	6.30	0	4.00	1	1	6.00	9	8.70
4	BR	1	2	4.56	0	0.00	0	0	0.00	4	2.75
5	BR	2	2	6.50	0	8.00	0	1	6.00	7	7.57
6	BR	3	2	3.00	0	0.00	0	0	0.00	0	0.00
7	BR	4	1	4.67	1	4.00	0	0	5.00	3	5.33
8	CL	1	2	5.33	1	0.00	0	0	5.00	5	9.00
9	CL	2	4	0.00	0	0.00	1	1	0.00	6	7.00
10	CL	3	1	7.71	1	0.00	0	0	8.00	1	0.00
11	CL	4	2	4.33	0	0.00	1	1	2.00	5	6.20
12	CL	5	1	2.78	1	0.00	0	1	3.00	3	6.00
13	CN	1	2	7.56	1	5.00	1	0	0.00	4	6.00
14	CN	2	3	0.00	0	0.00	1	1	0.00	6	4.50
15	CN	3	2	6.44	0	7.00	1	1	0.00	9	5.75
16	IN	1	4	3.22	0	7.00	0	0	5.00	5	1.83
17	IN	2	1	4.10	1	8.00	0	0	7.00	5	3.00
18	IN	3	1	2.22	0	4.00	0	1	8.00	6	2.17
19	IN	4	1	5.33	0	6.00	0	0	8.00	5	4.00
20	IN	5	2	5.90	0	3.00	0	1	7.00	9	4.56
21	IS	1	1	0.00	0	0.00	0	0	0.00	7	7.67
22	IS	2	1	4.14	1	0.00	1	1	3.00	4	2.60
23	IS	3	2	5.63	1	0.00	1	0	6.00	6	7.50
24	IS	4	3	5.50	1	0.00	1	0	8.00	3	7.67
25	MX	1	1	2.00	0	2.00	0	1	0.00	6	1.67
26	MX	2	2	6.17	1	6.00	0	0	3.00	9	7.22
27	MX	3	2	5.89	0	8.00	0	1	1.00	9	5.13
28	MX	4	1	1.50	1	4.00	0	1	0.00	6	6.17
29	MX	5	2	3.44	1	5.00	0	0	0.00	6	5.67
30	MX	6	2	7.78	1	4.00	1	0	5.00	9	7.29
31	SA	1	2	4.22	1	4.00	1	0	5.00	8	7.29
32	SA	2	2	5.78	1	8.00	0	1	7.00	3	5.67
33	SP	1	1	5.33	1	2.00	0	1	9.00	9	5.56
34	SP	2	2	4.56	0	5.00	1	1	6.00	3	4.86
35	SP	3	3	8.11	1	3.00	0	1	0.00	6	3.83
36	SP	4	1	5.80	0	0.00	0	1	0.00	7	6.57
37	SP	5	1	3.78	0	3.50	0	0	3.00	5	6.29
38	SL	1	1	4.33	0	0.00	0	0	7.00	0	3.00
39	SL	2	1	3.67	0	5.00	0	0	0.00	6	1.67
40	SL	3	1	7.11	0	4.00	0	0	5.00	2	7.00
41	CO	1	2	4.00	1	0.00	0	1	0.00	5	7.20
42	CO	2	3	5.38	1	0.00	1	1	0.00	5	7.40
43	IL	1	2	7.44	1	0.00	0	0	7.00	4	5.00

Table C.3. Survey Data on Administrative Variables (Cont'd).

Basic Details				Accountability		Information, Research, and Technological Capabilities							Evaluation
SL	CID	RID	EXP	AACCMN	AACCME	AARINF	AILINK	AILWRI	AILWES	AILWUR	ARELWR	AEXTST	AOEFWA
1	AU	1	2	1.00	4.00	8.00	7.33	8.00	7.00	7.00	5.00	0.00	9.00
2	AU	2	2	9.00	6.55	0.00	5.50	5.50	5.50	5.50	6.00	6.10	6.00
3	AU	3	1	7.00	6.71	6.00	5.00	5.00	5.00	5.00	5.00	6.40	5.00
4	BR	1	2	0.00	0.00	3.00	5.83	8.00	1.00	8.50	9.00	6.90	2.00
5	BR	2	2	4.00	7.00	9.50	4.50	4.50	4.50	4.50	6.00	5.50	6.00
6	BR	3	2	0.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00	2.60	4.00
7	BR	4	1	1.00	3.00	7.00	5.17	4.00	4.50	7.00	6.00	0.00	5.00
8	CL	1	2	2.00	10.00	5.00	5.33	5.50	5.50	5.00	9.00	6.50	8.00
9	CL	2	4	4.00	5.17	8.00	3.50	4.50	3.50	2.50	5.00	6.10	7.00
10	CL	3	1	4.00	9.50	0.00	0.50	0.50	0.50	0.50	0.00	7.80	8.00
11	CL	4	2	3.00	5.75	7.00	3.50	3.00	3.00	4.50	4.00	5.30	4.00
12	CL	5	1	1.00	3.50	5.00	2.00	2.00	2.00	2.00	2.00	2.90	1.00
13	CN	1	2	6.00	8.00	8.50	6.50	6.00	8.00	5.50	7.00	5.90	8.00
14	CN	2	3	4.00	2.33	5.50	5.33	6.00	4.00	6.00	5.00	2.90	8.00
15	CN	3	2	8.00	5.10	8.00	6.33	6.50	6.50	6.00	6.00	6.10	5.00
16	IN	1	4	5.00	3.00	4.00	2.50	2.00	3.50	2.00	5.00	2.10	6.00
17	IN	2	1	10.00	4.92	5.50	3.67	2.50	5.00	3.50	5.00	2.30	7.00
18	IN	3	1	4.00	2.50	2.50	2.50	3.00	2.50	2.00	2.00	2.10	3.00
19	IN	4	1	6.00	4.00	6.00	2.90	3.20	2.50	3.00	4.00	3.10	2.00
20	IN	5	2	4.00	3.50	7.00	5.50	5.50	5.50	5.50	5.00	5.25	6.00
21	IS	1	1	0.00	0.00	8.00	0.33	0.00	0.00	1.00	4.00	7.90	4.00
22	IS	2	1	4.00	1.63	2.50	3.00	3.00	3.00	3.00	4.00	1.70	3.00
23	IS	3	2	6.00	6.88	9.00	7.17	7.00	8.00	6.50	9.00	6.00	7.00
24	IS	4	3	4.00	6.00	7.50	6.50	6.50	7.00	6.00	8.00	5.80	9.00
25	MX	1	1	7.00	4.10	5.00	3.17	3.50	3.50	2.50	1.00	2.90	2.00
26	MX	2	2	8.00	7.38	7.50	4.33	5.00	3.00	5.00	3.00	3.80	5.00
27	MX	3	2	4.00	7.17	7.00	6.83	6.50	7.00	7.00	5.00	5.00	8.00
28	MX	4	1	6.00	6.25	7.00	6.33	7.00	6.00	6.00	7.00	6.10	6.00
29	MX	5	2	5.00	6.67	8.00	6.50	7.50	6.50	5.50	6.00	5.70	5.00
30	MX	6	2	10.00	7.75	8.00	7.83	9.00	8.00	6.50	8.00	7.50	7.00
31	SA	1	2	10.00	7.75	8.00	8.83	9.00	8.00	6.50	8.00	7.50	5.00
32	SA	2	2	5.00	7.17	5.50	7.50	7.50	7.50	7.50	7.00	4.90	4.00
33	SP	1	1	9.00	5.25	8.00	6.83	6.00	7.00	7.50	8.00	5.80	8.00
34	SP	2	2	6.00	5.88	7.00	4.67	7.00	4.00	3.00	6.00	5.10	6.00
35	SP	3	3	0.00	0.00	1.00	3.33	3.00	2.00	5.00	3.00	2.90	5.00
36	SP	4	1	7.00	6.42	7.50	2.67	2.00	4.00	2.00	2.00	4.40	1.00
37	SP	5	1	4.00	5.25	6.50	5.67	6.00	5.00	6.00	5.00	2.50	5.00
38	SL	1	1	3.00	5.25	7.00	4.50	4.00	5.50	4.00	2.00	1.60	3.00
39	SL	2	1	9.00	4.50	2.00	2.33	2.00	2.00	3.00	2.00	1.70	2.00
40	SL	3	1	1.00	4.00	5.00	9.00	9.00	9.00	9.00	8.00	5.50	2.00
41	CO	1	2	1.00	3.00	2.50	4.17	4.50	4.50	3.50	7.00	4.60	8.00
42	CO	2	3	0.00	0.00	8.50	6.50	6.50	6.00	7.00	7.00	4.40	7.00
43	IL	1	2	4.00	6.00	8.50	7.50	7.50	6.50	8.50	8.00	5.80	8.00

Table C.4. Survey Data on Performance Variables.

Basic Details				Performance of Water Sector					Overall Performance of Water Institution
				Physical	Financial	Economic	Equity	Overall	
SL	CID	RID	EXP	WSPPHY	WSPFIN	WSPECO	WSPEQU	WSPOEV	WIPOEV
1	AU	1	2	7.60	7.00	7.50	7.33	7.36	9.00
2	AU	2	2	6.30	4.00	7.00	1.67	4.74	8.00
3	AU	3	1	5.70	6.50	4.50	7.67	6.09	8.00
4	BR	1	2	6.50	4.00	5.50	6.00	5.50	5.00
5	BR	2	2	6.10	4.00	5.00	4.33	4.86	7.00
6	BR	3	2	6.10	6.00	5.50	2.67	5.07	8.00
7	BR	4	1	6.10	6.00	4.50	3.00	4.90	6.00
8	CL	1	2	6.00	6.50	5.00	2.33	4.96	7.00
9	CL	2	4	6.40	7.00	4.50	5.33	5.81	6.00
10	CL	3	1	6.70	7.00	9.00	6.00	7.18	6.00
11	CL	4	2	6.70	8.00	6.50	5.33	6.63	5.00
12	CL	5	1	6.70	7.50	7.50	4.00	6.43	7.00
13	CN	1	2	6.40	5.50	5.50	6.33	5.93	6.00
14	CN	2	3	5.80	5.75	5.75	6.50	5.95	5.50
15	CN	3	2	5.80	6.00	6.00	6.67	6.12	5.00
16	IN	1	4	4.30	3.00	1.50	3.33	3.03	2.00
17	IN	2	1	3.40	4.00	1.50	4.67	3.39	4.00
18	IN	3	1	3.40	3.00	2.00	2.33	2.68	5.00
19	IN	4	1	2.50	1.75	0.75	3.00	2.00	3.00
20	IN	5	2	2.70	2.50	1.50	4.00	2.68	6.00
21	IS	1	1	5.70	7.00	6.00	7.67	6.59	7.00
22	IS	2	1	7.80	6.50	7.00	7.33	7.16	6.00
23	IS	3	2	8.00	8.50	7.50	9.33	8.33	6.00
24	IS	4	3	8.30	7.00	5.00	6.67	6.74	7.00
25	MX	1	1	6.00	3.75	2.00	4.00	3.94	3.00
26	MX	2	2	4.70	4.50	3.50	4.50	4.30	4.50
27	MX	3	2	6.15	6.00	8.00	7.67	6.95	7.00
28	MX	4	1	5.90	4.13	2.75	4.25	4.26	3.75
29	MX	5	2	5.43	5.25	5.75	6.08	5.63	5.75
30	MX	6	2	6.03	5.06	5.38	5.96	5.61	5.38
31	SA	1	2	5.65	3.00	1.00	2.67	3.08	4.00
32	SA	2	2	5.40	3.00	1.00	2.67	3.02	4.00
33	SP	1	1	5.00	5.00	2.00	6.00	4.50	4.00
34	SP	2	2	5.13	4.73	4.17	6.50	5.13	5.17
35	SP	3	3	5.13	3.50	3.00	6.33	4.49	6.00
36	SP	4	1	6.20	5.70	7.50	7.17	6.64	5.50
37	SP	5	1	6.40	3.00	2.00	5.00	4.10	4.00
38	SL	1	1	4.60	2.50	1.00	4.00	3.03	2.00
39	SL	2	1	4.30	3.00	1.00	5.67	3.49	4.00
40	SL	3	1	4.35	2.75	1.00	4.83	3.23	3.00
41	US	1	2	6.10	8.00	6.50	7.00	6.90	7.00
42	US	2	3	6.10	6.50	6.50	4.67	5.94	8.00
43	US	3	2	5.90	9.00	6.50	8.67	7.52	9.00

APPENDIX-D: THE ENTIRE LIST OF EMPIRICAL VARIABLES IN ALPHABETICAL ORDER

AACCME =Effectiveness of the accountability arrangements evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AACCMN =Number/type of accountability arrangements;

AACORD =Extent of administrative coordination evident within water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AARINF =Adequacy/relevance of the information base evaluated in terms of judgmental perception and expressed on a scale of 0-10;

ABALFS =Balance in functional specialization, a dummy with 1 if balanced and 0 otherwise;

ADOMID =Extent of irrigation segment's domination within water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AEXCLD =Existence of an exclusive department for water sector, a dummy with 1 for existence and 0 otherwise;

AEXTST =Extent of science/technology application in water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AGBIWL =Extent of the influence/role of municipal or local governments evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AGBIWN =Extent of the influence/role of federal or national government evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AGBIWR =Extent of the influence/role of state or regional governments evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AGBIWS =Extent of the influence/role of statutory bodies in terms of judgmental perception and expressed on a scale of 0-10;

AIBDWP =Existence of an independent body for price determination/revision, a dummy with 1 for existence and 0 otherwise;

AILINK =Overall strength of the linkage that water administration has with research/extension agencies, universities, and researchers evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AILWES =Strength of the linkage that water administration has with experiment stations and extension bodies evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AILWRI =Strength of the linkage that water administration has with research bodies evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AILWUR =Strength of the linkage that water administration has with universities and researchers evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AOEFWA =Overall operational ability of water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AOFCAP =Overall functional capacity of water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AORGBA =Spatial organization of water administration taking a value of 0 for non-response, 1 if organized in terms of administrative divisions, 2 for the hybrid basis, i.e., in terms of both geographic divisions and hydro-geologic regions, 3 for broad hydro-geological regions, and 4 for river basins;

APFCSA =Existence of a functional linkage between pricing, fee collection, and service provision wings, a dummy with 1 for existence and 0 otherwise;

AREGME =Effectiveness of the regulatory arrangements evaluated in terms of judgmental perception and expressed on a scale of 0-10;

AREGMN =Number/type of regulatory arrangements;

ARELWR =Relevance of ongoing water research to current water sector challenges evaluated in terms of judgmental perception and expressed on a scale of 0-10;

ASADSS =Existence of specialized agencies for different water sub-sectors, a dummy with 1 for existence and 0 otherwise;

ASBUDC =Seriousness of budget constraint for water administration evaluated in terms of judgmental perception and expressed on a scale of 0-10;

ASREPU =Staff reduction potential through private sector/user participation evaluated in terms of judgmental perception and expressed on a scale of 0-10;

LACPRE =Overall effectiveness of accountability provisions evaluated in terms of judgmental perception and expressed on a 0-10 scale;

LACPRF =Average number of effective accountability provisions for both officials and users with a value range of 0-7;

LCRMEE =Effectiveness of conflict resolution mechanism(s) captured in terms of judgmental perception and expressed on a 0-10 scale;

LCRMEF =Legal forms of conflict resolution mechanism(s) with value ranging from -1 to 9 where -1 for none, 0 for unclear situation, 1 for bureaucratic systems, 2 for National Water Council and the like, 3 for Tribunals, 4 for Water Courts, 5 for judicial/legislative mechanisms, 6 for River Boards, 7 for Basin Organization and the like, 8 for WUAs, and 9 for multiple arrangements;

LIGRES =Legally specified inter-governmental responsibility in the water sector as a whole with a value range of 0-6 where 0 for none/no water law, 1 for national government alone, 2 for national+state/regional governments, 3 for national+state/regional+local governments, 4 for state/regional government alone, 5 for state/regional+local governments, and 6 for local government alone;

LINTRE =Overall ability of the water law to provide a legal framework for an integrated treatment of water from various sources evaluated on a scale of 0-10;

LLIBWO =Legal linkages that water--both surface and sub-surface--has with land, environment, and inland fishing. It is a scale variable with a range of 0-10 and is obtained by averaging the judgmental values given for each of these three linkages;

LOECEN =Extent of centralization tendency evident in water law evaluated on a scale of 0-10;

LOEFWL =Overall effectiveness of water law evaluated on a scale of 0-10;

LOEPRV =Legal scope for private sector participation in water sector evaluated on a scale of 0-10;

LPRGRF =Form of groundwater rights with a value range of 0-5 where 0 for open access regime, 1 for unclear/unauthorized/scattered rights, 2 for common/state property, 3 for capture or appropriative rights; 4 for correlative (proportional) rights, and 5 for licenses/permits;

LPRLRF =Form of local level property/use rights in water with a value range of 0-4 where 0 for no rights, 1 for unclear/unauthorized/scattered rights, 2 for recognized group/collective rights, 3 for clear individual rights, and 4 for multiple forms of rights;

LPRORE =Overall effectiveness of property/use rights system in water evaluated in terms of judgmental perception and expressed on a 0-10 scale;

LPRQRF =Form of rights in water quality having a value range of 0-4 with 0 for none, 1 for unclear rights, 2 for quality standards, 3 for pollution permits and the like, and 4 for multiple forms of rights;

LPRSRF =Form of surface water rights with a value range of 0-6 where 0 for no rights, 1 for unclear/unauthorized/scattered rights, 2 for common/state property, 3 for riparian system, 4 for appropriative system, 5 for correlative (proportional sharing) system, and 6 for licenses/permits;

LTRWSA =Legal treatment of surface and subsurface sources. It is dummy variable with 1 if both sources are treated alike but 0 otherwise;

LTRWSD =Layers of legal discrimination in water use. It takes a value in the range of 0-4 with 0 for no discrimination and counting one for each category of discrimination like water source, sector, user, and use;

PCOREC =Cost recovery status with 0 for non-response, 1 for full subsidy, 2 for partial recovery, and 3 for full-cost recovery;

PEXTPP =Extent of private sector participation in the water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PEXTUP =Extent of users' participation in the water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PGPIPP =Impact of private sector promotion policy evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PGPIUP =Impact of the policy for promoting users' participation evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PGPTPP =Existence of government policy for promoting private sector participation, a dummy with 1 for existence and 0 otherwise;

PGPTUP =Existence of government policy for promoting users' participation, a dummy with 1 for existence and 0 for otherwise;

PIRSWE =Smoothness of inter-regional/sectoral water transfers evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PIRSWM =Means for inter-regional/sectoral water transfers with 0 for none, 1 for pure political dictate, 2 for administrative decision, 3 for judicial injunction/order, 4 for negotiation, and 5 for water markets;

PIRSWO =Organizational basis for inter-regional/sectoral water transfers with 0 for none, with 1 for tribunals, 2 for River Boards, 3 for basin level organizations,

and 4 for other decentralized systems (e.g., stakeholder and water user organizations and water markets);

PIRSWR =Reasons for inter-regional/sectoral water transfers with 0 for none, 1 for historical or political reasons, 2 for equity concerns, 3 for resource conditions, 4 for economic considerations, and 5 for multiple reasons;

PIRSWT =Existence of inter-regional/sectoral water transfers, a dummy with 1 for existence and 0 otherwise;

PNGOFA =Extent of participation/influence by donors/lenders evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PNGOFP =Extent of participation/influence by foreign private technical/investment firms evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PNGOOP =Extent of NGO (user groups, private sector, donors/lenders, and foreign private technical/investment firms) participation evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PNGOPS =Extent of private sector participation evaluated in terms of judgmental perception and expressed on a scale of 0-10;

PNGOUG =Extent of User groups' participation evaluated in terms of judgmental perception and expressed on a scale of 0-10;

POATPP =Officials' attitude towards user participation with 0 for non-response, 1 for opposition, 2 for indifference, 3 for non-favorable, 4 for favorable in select sector, and 5 for favorable overall;

POEFWP =Overall effectiveness of water policy evaluated in terms of judgmental perception and expressed on a scale of 0-10;

POELWL =Extent of linkages between water law and water policy evaluated in terms of judgmental perception and expressed on a scale of 0-10;

POPAWE =Extent of influence of these policies on water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

POPAWN =Number of other policies affecting water resource development and use;

PPRREV =Frequency of water charge revision with 0 for non-response, 1 for no revision, 2 for rare revision, 3 for infrequent or delayed revision, and 4 for frequent revision;

PPSCRI = Project selection criteria having a value range of 0-6 with 0 for non-response, 1 for political dictate, 2 for equity factors, 3 ecological factors, 4 for benefit-cost ratio, 5 for internal rate of return, and 6 for multiple criteria;

PUATPP =Users' attitude towards private sector participation with 0 for non-response, 1 for opposition, 2 for indifference, 3 for non-favorable, 4 for favorable in select sector, and 5 for favorable overall;

WIPOEV =Progressiveness or the overall adaptive capacity of water institution taken as a whole evaluated in terms of judgmental perception and expressed on a scale of 0-10.

WSPECO =Economic Performance of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

WSPEQU =Equity Performance of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

WSPFIN =Financial performance of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

WSPOEV =Overall performance of water sector obtained by averaging WSPPHY, WSPFIN, WSPECO, and WSPEQU; and

WSPPHY =Physical performance of water sector evaluated in terms of judgmental perception and expressed on a scale of 0-10;

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