THE EVOLUTION OF GOVERNANCE INSTITUTIONS:

AN IMPLEMENTATION PERSPECTIVE

by

JASON MATTHEW PEEK

(Under the Direction of Andrew Whitford)

ABSTRACT

This dissertation submits a policy implementation framework for the analysis of governance institutions and their performance. By examining the relationship between water institutions and implementation environments, the proposed implementation framework provides a typology of water institutions that is used to analyze their ability to mitigate water scarcity. Using the following research strategies: (1) a confirmatory factor analysis of policy implementation dimensions affecting institutional design, (2) a quantitative analysis of country-level data to measure relationship between institutional typologies and institutional performance, and (3) a quantitative analysis of state-level policy adoption data to measure the effects of implementation dimensions on drought management plan adoption, I find support for the proposed framework. The framework also provides insight into the relationship between policy implementation and institutional performance. Data have been compiled from existing studies on water institutions, national, and international datasets. This dissertation expands the previous research on institutional governance by providing a policy implementation framework for institutional analysis.

INDEX WORDS: Policy Implementation, Institutions, Institutional Analysis, Water, Water Institutions, Water Scarcity, Drought Management

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DEDICATION

I dedicate this work to my family. Especially Gina, Jenkins, and Hampton for their loving support and patience that carried me through this long winding path of my scholarly pursuits. I am grateful for the support and encouragement from my parents Bena and Barry, who started me on this path at an early age by fueling my passion for knowledge and community. I am indebted to my brother Jarret, who continues to inspire his big brother to keep exploring.

I also dedicate this work to the many friends and colleagues that have supported me through this process. Lastly, I dedicate this work to the practitioners of local governments around the world, whose conversations continue to shape my experience and understanding of the importance of public administration.

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Finally, I would like to thank my teachers and mentors that have shaped and influenced my life. Their shared experience and willingness to give continues to push me forward with Tennyson's words ringing in my ears "To strive, to seek, to find, and not to yield."

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CHAPTER 1

The Evolution of Institutions

Research Questions

"Water, Water, Everywhere, Nor any drop to drink." The lament of the Ancient Mariner reminds us of the many paradoxes associated with water. The visible abundance of water in the world does not comport with reports of water scarcity. The environment of the Ancient Mariner is similar to the policy implementation environments faced by our water governance institutions today. These implementation environments often include disparity between modes of governance, viable policy solutions, and policy problems. A better tool is needed to understand the relationship between policy implementation environments and governance institutions.

Water institutions provide a ripe example to study implementation environments, institutions, and performance. Water scarcity is a policy problem faced by water institutions. Technology exists to desalinate seawater, but water scarcity is still present despite the oceans' abundant resources (Glennon, 2009). Technology like desalination is only a tool within a larger governance framework that water institutions use to mitigate scarcity. It is not a panacea to solve all scarcity problems. Water institutions' ability to mitigate water scarcity is not only dependent on each institution's technical/engineering resources. More importantly, capability is dependent on actual governance structure (legal, management, and policy systems) and the policy implementation environment. The purpose of this dissertation is to

propose a policy implementation framework that provides direction on the relationship between policy implementation environments and institutional performance.

I quantitatively examine the relationships between variations in governance frameworks of water institutions and water scarcity under different policy implementation environments. I propose an implementation framework that defines institutional typologies and expected performance. Institutional performance is examined through measures of water scarcity policy outputs and outcomes. Policy outputs are defined as the products and processes that result from policy decisions, whereas outcomes are the results associated with policy goals and actions. Analysis of policy outputs and outcomes are based on measures of access to clean water and sanitation and drought management. The research is primarily concerned with development of a theoretical framework for analyzing institutional performance based on policy implementation environments. The framework will be used to test hypotheses about variations of institutional components' effects on policy outcomes across different countries. The hypotheses will be examined through a policy implementation approach to typologies of governance frameworks under different policy setting environments (Hill & Hupe, 2009; Matland, 1995).

Specifically, the Implementation Framework for Institutional Analysis (IFIA) sheds light on the following research questions:

1. What types or modes of governance for institutions are present in different policy implementation environments?
2. What is the relationship between implementation environments and institutional performance?
3. Is the framework applicable to different levels and locations of agreement on policy values and policy knowledge within institutions?

Why Does Policy Implementation Matter to Institutions?

Policy implementation is as important as the policy decision itself (Pressman & Wildavsky, 1979). The study of policy implementation does not have a singular theory or sole framework for guidance, but it is an area of significant importance for understanding the process from policy formation to policy output. While many studies of institutions focus on the internal components of institutional design, all frameworks include an exogenous influence on the governance structure (Ostrom, 1999; Saleth & Dinar, 2004). Ostrom's Institutional Analysis and Development Framework (1999) lists biophysical conditions, community, and rules as exogenous influences on institutional decision-making or action arenas. Saleth and Dinar's Institutional Decomposition Analysis Framework (2004) dissects the interworking components of institutions and lists environment, political system, legal systems, economic development policies, and demographic factors as key exogenous influences on institutional design. Both of these frameworks list exogenous factors that exert influence on institutional performance during policy implementation.

I suggest that these exogenous influences on institutional design are surrogate measures of the level of agreement on policy values and policy knowledge at work in policy implementation environments. These environments are feedback loops that shape many factors within the policy process, including problem definition, agenda setting, policy formulation, and evaluation. I propose that these implementation factors directly influence an institution's design and, ultimately, institutional performance. Hill and Hupe (2009) suggest that the study of implementation has followed paradigm shifts similar to those experienced in Public Administration, from early formations as a "problem solving paradigm" to the current state of the field as a "governance paradigm." They characterize the

governance paradigm for research in policy implementation as a study "with explicit attention to action." The institutions and their modes of governance are the action centers for the policy process that operate under changing policy implementation environments.

Current State of Water Institutions

Water institutions provide a good case for examinations of the relationship between policy implementation and institutions. The study of water resource management has evolved from a hydrocentric engineering perspective focused on increasing water supply and delivery to new paradigms of integrated watershed management (IWM) and global water initiatives (Varady et al., 2009). IWM, which is also known as Integrated Water Resource Management (IWRM), is a process that "brings together fragmented water users into an integrated planning, allocation, and management framework" (Fischhendler, 2008). Furthermore, IWM expands the geographic limits of decision making to include an entire watershed as opposed to a single political boundary.

The IWM paradigm has broadened the management perspective within water institutions to recognize the need for "sophisticated institutional arrangements, democratic structures, and patterns of governance that are polycentric rather than unicentric" Molle, 2006, pg. 20). However, as Molle and others (Brichieri-Colombi, 2009; Feldman, 2007; Figuères, Rockström, & Tortajada, 2003; Fischhendler, 2008) point out, IWM still implies a hydrocentric focus that does not consider the larger political environment that ultimately influences policy outcomes.

Current Policy Setting for Water

One of the problems of a hydro-centric viewpoint is the significant impact of a larger policy environment on the policy implementation process (Conca, 2006). Policy

implementation plays an important role in determining policy outcomes (Pressman & Wildavsky, 1979; Robichau & Lynn, 2009). When institutions fail to consider the policy setting environment, the results may be flawed implementations. Matland (1995) suggests that the degree of political conflict and level of policy ambiguity, described as policy setting environments, influences policy implementation. Different policy setting environments create different institutional responses to address policy problems (Hill & Hupe, 2009). Table 1 provides the four policy setting environments and the likely implementation process as developed by Matland.

Table 1. Matland's analysis of conflict and ambiguity upon implementation

Policy Implementation Environments

	Low Conflict	*High Conflict*
Low Ambiguity	Administrative Implementation	Political Implementation
High Ambiguity	Experimental Implementation	Symbolic Implementation

Source: Adapted version of the table in Hill and Hupe (2009, p. 177).

Water institutions have not adapted well to the changes in policy implementation environments. The traditional policy setting environment of water institutions was low political conflict and low goal ambiguity—an environment best suited to technical problem solving from isolated administrative agencies that operate in an environment where rules and risks are well defined and there is little significant outside opposition. The hydro-centric viewpoint does not fully recognize that the policy setting environment for water scarcity has

changed from low political conflict and low ambiguity (Matland, 1995) to high political conflict and growing technical complexity (Molle, 2006). The change in policy setting explains why modifications to water institutions is seen as the primary mechanism to address water scarcity (Conca, 2006).

The current policy setting for water scarcity can be described as an arena of high conflict and, at times, high ambiguity on policy goals. Resources, including both the physical supply of water and the financial resources for technology, are not guaranteed to be sufficient to address policy problems. In addition to diminished resources, consensus on policy prescriptions is low, often pitting market-based solutions against local collective governance (Iyer, 2007).

Globalization has moved concerns about domestic water shortages onto the international agenda as a primary global security issue in the 21st century (Tirado, Cohen, Aberman, Meerman, & Thompson, 2010). For example, lack of water in agricultural regions could affect world food prices and disrupt domestic and international supply chains. These water shortages are not solely attributable to climatic factors; they also result from using virtually non-renewable[1] water supply sources.

Global discussions about water scarcity and water resource management have focused on various aspects of water institutions and the evolution of changing governance paradigms (Varady et al., 2009). Varady et al. suggest that governance paradigms of water have evolved from state-led central institutional control, to rational actor free market frameworks, to structural adjustment and neoliberal institutionalism, to the current paradigm of sustainability and decentralization.

[1] Some deep glacial groundwater aquifers are classified as non-renewable because the consumption of water from the aquifers far exceeds the ability to recharge them through the natural hydrological cycle.

Inherent within each governance philosophy is growing disagreement on solutions to water scarcity. The proposed solutions can be categorized into reforms to supply management and reforms to demand management. The supply management paradigm asserts that large infrastructure investments are needed to create additional water supply. This philosophy peaked in the 1960s with the last construction boom of large dams (Conca, 2006; Gleick, 2000). As environmental awareness and social movements grew, the construction of large dams declined. Proponents for changing the supply management paradigm argue for the soft path of water, which advocates for mechanisms to create economic efficiency to regulate supply and demand of water with added emphasis on demand (Gleick, 2009). The lack of consensus on policy solutions for water scarcity suggests that prescriptions for institutional changes to water governance might not lead to the policy outcomes that policy makers and constituents desire. This aspect of institutions might be especially true when selected prescriptions do not consider the relationship between existing governance frameworks and their implementation environments. In order to better understand the transitions in institutional modes of governance and their relationship to implementation environments, a historical perspective of the evolution of water institutions is needed.

Evolution of Water Institutions

Institutional change is driven by many factors (North, 1990). North (1990) asserts that economic behavior drives institutional change through demand for investment in knowledge, ongoing interaction between institutional activities, and incremental alteration of informal constraints. While North's viewpoint is economic centric, it is useful for discussing institutional change from the policy implementation perspective. Institutional change occurs

within our governance institutions as a result of the behavior and decision-making of individual and collective institutional actors. The behavior of these actors within a policy implementation environment is driven by their respective policy values and policy knowledge. As levels of agreement on values and knowledge change between actors, institutions evolve. The levels of agreement change due to acquisition of knowledge, ongoing interaction between actors, and incremental changes to institutional constraints. The evolution of water institutions provides a narrative of the process of institutional change.

Four major epochs have affected the development of water institutions throughout history. These epochs also represent a macro view of implementation environments during institutional change. The term epoch, as used here, represents periods where significant developments occurred with respect to water institutions. Culture is defined by Merriam Webster (2007) as **"**the integrated pattern of human knowledge, belief, and behavior that depends upon the capacity for learning and transmitting knowledge to succeeding generations" (Merriam-Webster, 2007). Changes in water institutions are directly related to changes in culture that affect values and knowledge among institutional actors. For the purposes of this dissertation, institutional epochs are examined through successive cultural epochs that influenced changes to water institutions.

Water institutions have been a core element of civilization since humans have been able to divert water for irrigation and create cities (Solomon, 2010). Solomon states, "breakthrough responses that harnessed new water resources by novel means in one epoch sowed new conditions from which emerged the defining water challenges, and opportunities, of the next." Likewise, these breakthroughs required changes to water institutions in order to adapt to new environments.

Identifying the relevant epochs in water institutions depends on the analytical lens used for investigation. Varady and McGovern (2003) suggest that the most significant changes in water governance have occurred since 1950. Scholars from other fields have attributed significant developments in water institutions to ancient and indigenous cultures (Groenfeldt & Svendsen, 2000; Solomon, 2010; Wittfogel, 1957). The contributions to institutional governance from past civilizations occurred long before the 1950s and established much of the basis for modern water law. Much like any study of history, the context of inquiry defines periods of significant development with respect to modern institutions.

A subset of the cultural analysis lens is technology. Technology is intrinsic to culture (Pacey, 1983). Pacey describes how bore wells in India were initially unsuccessful in providing additional water supply. The new technology of deeper bore wells and new hand pumps alone did not improve supply performance. Changes were needed to management and organizational structures to ensure the success of the technology. This story is typical of many foreign aid projects, which often fail to understand the relationship between culture and technology necessary to address water resource issues (Brichieri-Colombi, 2009).

Technological innovations have played a significant role in the development of water institutions. The technical knowledge necessary to construct large dams and irrigation canals and desalinate water are examples of technology that have and will continue to influence changes to water resource management. However, technology is a response to shifts in cultural change; it is not always the primary driver of cultural change (Pacey, 1983). The intent of this chapter is to understand how culture has changed water institutions with respect to administration, law, and politics.

The evolution of water's cultural epochs has influenced significant changes in water institutions. Water institutions have evolved through four major cultural epochs: Irrigated Agriculture, Urbanization, Environmentalism, and Globalism. Each of these cultural epochs corresponds to a specific institutional mode of governance. Figure 1 illustrates the suggested epochs that have significantly influenced water institutions over time.

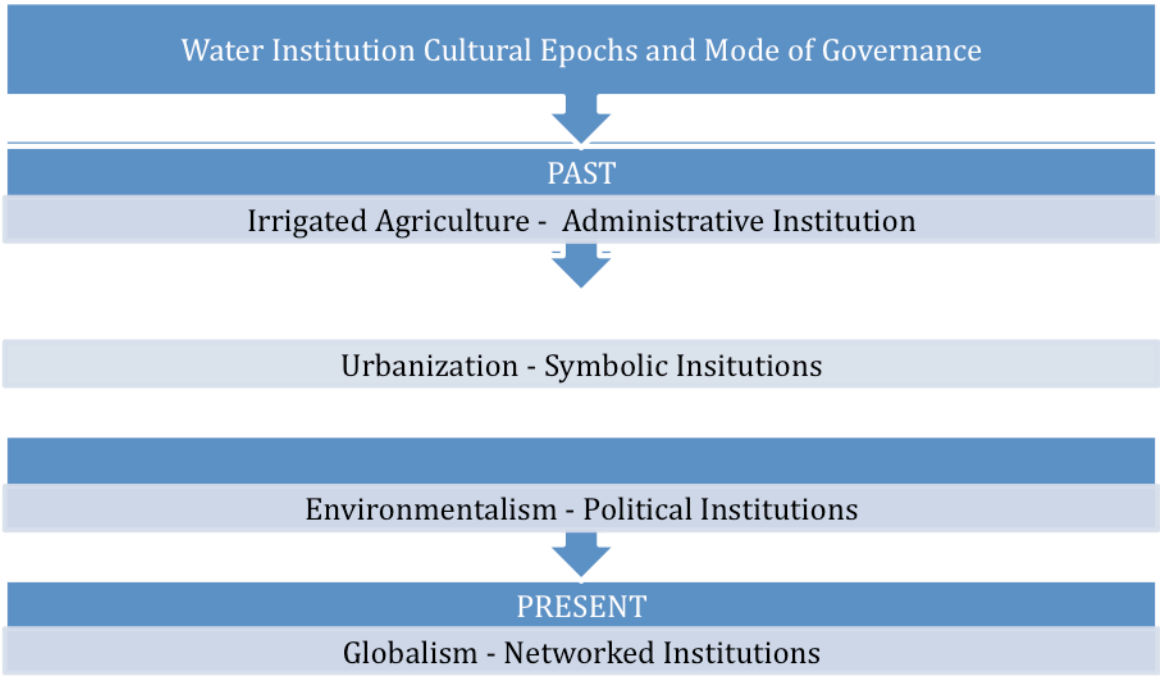


Figure 1. The evolution of water institution through cultural epochs.

An overview of these periods is necessary in order to understand the paradox of water institutions. Effective governance of water institutions is the key variable to address problems of water scarcity. However, governance of water institutions is also the greatest obstacle to overcome problems of water scarcity. The current forms of governance within water institutions reflect the changes to macro implementation environments of each of the cultural epochs.

Cultural changes have affected the very idea of water (Linton, 2010). Linton suggests that worldwide culture has changed the very nature of water, from early associations of water as a spiritual source to modern day abstractions that water is solely a commodity. The changes in management paradigms are also continuously evolving, from management focus on an isolated resource related to specific supply needs to an integral resource affecting everything from land use decisions to energy policy.

Epochs: Culture and Water Governance

The cultural place of water institutions has been integral to the development of society as a whole (Wittfogel, 1957). The significance of water is deeply rooted within society's culture. Most creation stories of mankind associate life's origin with water (Solomon, 2010). Water institutions were especially important for the rise of great ancient civilizations spanning the globe. Solomon describes how integral water was to the culture of the earliest large-scale civilizations: Egyptian, Indus, Mesopotamian, and Chinese Dynasties. The ability to divert and control water led to the rise of large-scale agricultural production that supported large concentrations of people. These civilizations created "hydraulic societies" (Wittfogel, 1957) and the first significant cultural epoch of water governance.

Cultural Epoch: Irrigated Agriculture

Wittfogel asserts that these "hydraulic societies" are characterized by centralized planning and an authoritarian organization focused on exploiting water resources. Hydraulic societies required significant labor forces to maintain extensive waterworks, such as dams, canals, and levees. Maintenance of this early infrastructure required new developments in organizational structures and the creation of water policies. These early developments in water institutions created forms of a civil bureaucratic hierarchy, as opposed to military

governance. Along with the organizational structure necessary to administer the waterworks, codifications of water law occurred (Solomon, 2010). From ancient Babylon, Hammurabi's code of justice included several laws related to the use of water and water-use rights and responsibilities for various kinds of infrastructure maintenance (Solomon, 2010).

The development of rules for the allocation and management of water also created the need to resolve conflicts. Groenfeldt suggests that management of water requires all societies to develop "universal management functions' such as the need to mobilize labor, to allocate water, and to institute methods of resolving disputes" (Groenfeldt & Svendsen, 2000). These observations coincide with current descriptions of water institutions as forms that consist of administration, policy, and law (Saleth & Dinar, 2004).

Groenfeldt also suggests that the "management functions," while universal in typology, are unique to each indigenous system, dependent on social and cultural characteristics, physical environment, and the particular individuals involved. Likewise, Wittfogel acknowledges that not all "hydraulic societies are despotic societies." The very nature of hydraulic societies required different organizational forms, rules, and political environments than had previously existed.

Wittfogel suggests that Oriental agricultural societies differed from western agricultural societies primarily due to division of labor and the need for large-scale cooperation in the arid eastern regions. Western agriculture developed in water-rich areas able to support small-scale irrigation farming. Oriental agriculture required large-scale operations to provide large water supplies to areas far from water. These large-scale operations were managed through bureaucratic control and codification of rules. The centralized planning of water resources remained the predominant management trend until the 1950s (Varady et al., 2009).

Cultural Epoch: Urbanization

The industrial revolution and the growth of modern cities represented a significant change for water institutions (Solomon, 2010). Water was no longer solely a temporal issue for agriculture, but a necessary input for industrial production and the growth of the modern metropolis. Water supply was a resource to be managed in order to ensure adequate supply. Industrialization increased the demand for water, which led to the delineation of the profession of water manager.

These early managers were traditionally engineers who were well versed in treatment works, supply studies, and civil works construction (Baker, 1949). In addition to their technical knowledge, these professionals had to manage the political aspects of cities (Troesken, 1999). Troesken describes how public officials in the United States and Europe implemented a massive reduction in private water providers under the cause of public health.

The stresses of urbanization and industrial development also brought attention to public health due to the contamination of water supplies. Protection of water supplies and management of sewage became an added component of water management. Now water managers were required to consider externalities beyond simple water supply. Troesken states that many cities argued that public provision of water supply would be better for citizens because private firms did not have proper incentives to install costly treatment works.

Cultural Epoch: Environmentalism

The twentieth century marked the dawn of the environmental movement as it related to water resources. Water pollution from municipal, industrial, and agricultural sources required significant changes to existing water institutions. The United Nations held the first Conference on the Environment in 1972. The environmental movement had started prior to

the 1970s, but the most significant legislation related to environmental controls was established in that decade.

In the United States, the 1972 Clean Water Act established a new regulatory environment. Many European countries were on a similar path after the European Council committed to establish an Environmental Action Programme in 1973 (Hey, 2005). These policy decisions required significant changes to water management. Water managers now had to consider impacts of additional supply sources and develop more comprehensive plans to address impacts. The environmental movement also gave voice to different stakeholders that opposed new water supply projects and increased wastewater discharges. Water managers could no longer hide behind technical expertise; they had to confront public criticism.

Cultural Epoch: Globalism

The rise of global water institutions marks the current epoch of cultural trends related to water institutions. Globalism has led to the creation of global water governance through such organizations as the World Water Council and the Global Water Partnership (Varady et al., 2009). Varady et al. suggest that "global water initiatives" can be attributed to the complex challenges of environmental management.

The complexity of environmental management requires cooperation between states and nations in order to address the multiplicity of policy issues affected by water, including but not limited to public health, food supply, power generation, and security. Globalism has instituted initiatives to standardize the planning and management paradigm through use of Integrated Water Resource Management (IWRM). A working definition of IWRM has been developed by the Global Water Partnership-Technical Advisory Committee (Comittee, 2000) as follows: "Integrated water resources management is a process, which promotes the

coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (p. 22).

IWRM requires water professionals not only to consider impacts outside of their political jurisdiction, but also to actively encourage participation from all stakeholders within a watershed. Globalism has required a new level of collaboration in water resource management. This collaboration represents a significant changed from the central state-planning paradigm created during the original hydraulic societies.

The four significant cultural epochs of water institutions illustrate how central state planning was integral to their initial formation to serve early hydraulic societies. Water Institutions that provide irrigated agriculture used an administrative mode of governance. These Administrative Institutions were largely hierarchical with a concentrated agreement on institutional values and knowledge. Urbanization ushered in Symbolic Institutions that worked to standardize institutional practices through the rise of water resource professionals. These professionals operated fragmented institutional systems without need for agreement on larger institutional values or knowledge. The urbanization epoch represented a symbolic mode of governance, meaning that the scope and power of the institutions was largely based on strength of coalitions. Only as the water resource profession developed did a more formalized institutional structure begin to form. Next, environmentalism challenged traditional notions of supply management, which required institutions to adapt their planning efforts and respond to additional stakeholders. This caused water institutions to evolve into Political Institutions. Institutions, during this epoch, operated with a political mode of governance, in which the power of water institutions was changed to recognize a new coalition of institutional actors. Globalism has continued the trends ushered in by the

environmental movement, leading to the rise of Networked Institutions. Water institutions now operate in a networked environment with multiple stakeholders at multiple levels across many political boundaries. These water institutions must rely on a networked mode of governance to bring about institutional action that is reflective of contextual conditions.

Understanding the contributions of differing cultural epochs is useful in understanding the current state of water institutions. Each cultural epoch has demonstrated that the management of water is deeply rooted in governing structures. The cultural epoch provide snapshot of the predominant modes of governance at work: Administrative, Symbolic, Political, and Networked. Central to the modes of governance of water institutions is a general expectation of publicness, which highlights the fact that institutions must respond to diversity of values and disparity of knowledge in order to address complex water problems (Conca, 2006).

Theoretical Foundation

This dissertation proposes a policy implementation framework for institutional analysis. This framework is used to examine the relationship between implementation factors and water institution performance through analysis of "modes of governance" (Hill & Hupe, 2009). Hill and Hupe suggest that implementation theory can be leveraged to identify probable governance frameworks that will operate under different policy implementation environments. An implementation approach to institutional analysis offers a novel method for understanding the relationship between institutions and performance.

Methodology

The proposed Implementation Framework for Institutional Analysis (IFIA) is derived from a literature review of policy process, institutions, and policy implementation.

The framework is tested through a confirmatory factor analysis based on institutional data collected and compiled by Saleth and Dinar in their 2004 study of the performance of water institutions and historical assessment of the evolution of water institutions. Validation of the effects of implementation environments on policy outcomes is examined through a case study of different measures of water scarcity. Water scarcity measures include access to clean water, access to improved sanitation, and adoption of drought management plans.

Data for the analysis were compiled from different primary and secondary sources. Data for the validation of implementation environments was compiled from a 2004 World Bank study of water institutions. Drought management data were compiled from the National Drought Mitigation Center for the United States. Data on clean water and access to sanitation were compiled from the United Nations Development Programme Joint Monitoring Program and the World Bank. The primary independent variables are drawn from typologies of water institutions. Dependent variables are based on measures of policy outputs and policy outcomes.

Structure of the Dissertation

The dissertation is comprised of six chapters: Chapter 1 – Introduction; Chapter 2 – Implementation Framework; Chapter 3 – Framework Validation; Chapter 4 – Water Institutions: An Implementation Perspective; Chapter 5 – Implementation Environments and Administrative Institutions; Chapter 6 –Conclusion.

Chapter 2 builds a case for institutional modes of governance under different policy implementation environments. The institutional modes of governance are derived from a policy implementation perspective. Furthermore, the policy implementation environments

identify the ideal operational modes of governance for the respective implementation dimensions.

Chapter 3 tests the proposed framework through a confirmatory factor analysis using institutional data on water institutions. The chapter also provides an introduction to water institutions and their institutional components.

Chapter 4 investigates how variations in implementation environments are related to institutional performance as measured by water scarcity. Two dependent variables, percentage of population within a country that has access to improved water and percentage of population that has access to sanitation facilities, are used to compare different measures of water scarcity. The independent variable includes the previously developed policy implementation factors and controlling variables.

Chapter 5 examines the influence of a single policy implementation environment on adoption of drought management plans. The dependent variable consists of panel data from drought policy adoptions within the continental United States. The independent variable consists of the key policy implementation factors.

Finally, the dissertation concludes with Chapter 6, which synthesizes research findings from the preceding chapters. This chapter discusses the implications of the proposed framework and specifies future research questions.

CHAPTER 2

The Study of Institutions: An Implementation Perspective

Policy implementation is as important as the policy decision itself (Pressman & Wildavsky, 1979). Pressman and Wildavsky shined a light on a key area of public policy research that contributes to institutional performance: policy implementation. The ability of institutions to transform policy decisions into action and ultimately outcomes is dependent on the policy implementation environment. The examination of the nexus between performance and institutions necessitates significant work evaluating the internal institutions mechanisms at work with little treatment of the influence of implementation environments. The performance of institutions is a result of the interaction between the exogenous influences and the institutions (Saleth & Dinar, 2005; Ostrom, 2005). Ostrom's framework identifies three factors as exogenous influence: community, environment, and rules. While her framework provides traction on exogenous influence its primary focus is on the interaction of participants under different action situations. Similarly, Saleth and Dinar's framework examines the internal workings of institution while controlling for several exogenous influences. Both of these frameworks can be improved by a refined specification of exogenous influences on institutional structure and performance. The proposed policy implementation framework presented in this chapter addresses this need and provides a novel approach for institutional analysis.

Institutional frameworks have several common themes: rules, institutional components, and exogenous influences. I propose that these exogenous influences reflect a

two-dimensional policy implementation environment based on dimensions of values and knowledge. These two dimensions contribute to institutional design and ultimately to institutional performance measured through policy outcomes. The framework is described by the following in Figure 2.1.

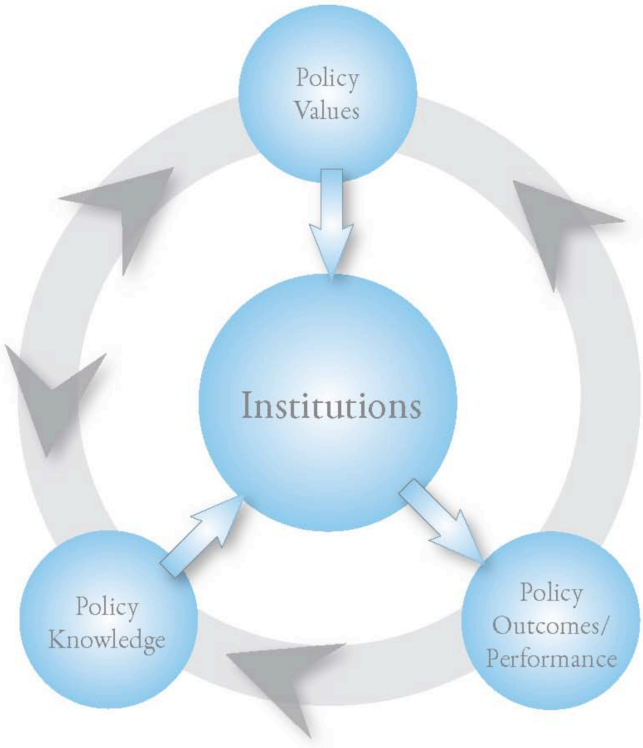


Figure 2.1 Implementation framework of institutional analysis.

I provide a full explanation of the framework after a brief overview of the literature on institutions, governance, and policy process. The overview is necessary to understand the importance of an implementation framework for institutional analysis. After the literature review, the policy implementation framework is further refined into a working model of institutional analysis. The working model is presented through several case examples as

points of reference to show the practical application of the framework and implications for institutional performance.

Institutions

Theoretical approaches to institutional research are available in the fields of Economics, International Relations, Political Science, Public Administration, and Public Policy (Araral, 2010; Fischhendler, 2008; E. Ostrom, 1992; Saleth & Dinar, 2004; Varady, et al., 2009). For the purposes of this dissertation, the objective is to identify current trends in institutional research and similarities to the growing literature on governance while providing support for the proposed policy implementation framework for institutional analysis.

Definitions of institutions are quite similar across multiple disciplines. Literature in Institutional Economics identifies institutions as systems of rules and rights among individuals and organizations that define the processes for achieving desired actions (Saleth & Dinar, 2004). Literature in International Relations and Hydropolitics examines institutions as regimes. Regimes are defined as groupings of norms, rules, and decisions making procedures that are focal points for international actor's expectations related to international relations" (Krasner, 1982). The concept of a regime is the same as that of an institution. The fields of Public Policy and Public Administration have defined institutions as "aggregations of norms, values, rules, and practices that shape or constrain political behavior"(Peters & Pierre, 1998). Common to all of these definitions is an agreement that institutions are systems with rules, practices, and rights that define the environment in which actions occur.

General Theoretical Approaches to Institutions

The field of Economics has developed several approaches to the study of institutions (Saleth & Dinar, 2004). Saleth and Dinar provide a comprehensive literature review of

approaches to institutional analysis based on institutional economics. They identify five distinct theoretical approaches: Old Institutionalism, Neo-institutionalism, Meso-Corporatism Policy Community Networks, Game Theory, and Transaction Cost Theory/Agency Theory. Critical to this dissertation is the relationship of institutions to institutional performance. Saleth and Dinar discount most of the approaches as inappropriate for analyzing institutional performance and institutional linkages at a macro level. Neo-institutionalism is identified as the most promising approach because it recognizes bounded rationality and incomplete information in economic choice.

A major gap that Saleth and Dinar identify among the previous institutional approaches is the lack of a better understanding of institutional linkages and institutional decomposition. Their report for the World Bank (2004) provides a basis to address this concern with the development of the Institutional Decomposition Analysis framework, which divides institutions into three distinct components: law, policy, and administration.

The field of Political Science borrows several approaches from the Institutional Economics literature. Ostrom's work on Institutional Analysis and Development (IAD) is most prominent in its broad applicability, especially in examination of common pool resources, such as water. The IAD framework defines institutions as combinations of prescriptions and constraints that individuals use to inform and organize repeated interactions at all levels (Ostrom, 2005). Within IAD, institutions can be formal structures with well-defined rules and norms or informal structures with implied rules and norms.

The field of International Relations examines institutions through regime theory (Evans & Wilson, 1992) . Regime theory defines regimes or institutions as "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations" (Krasner, 1982). However,

regime theory as applied to institutions limits itself to the arena of political decision-making (Hurrell, 1993). Warner and Zeitoun (Warner & Zeitoun, 2008) have also criticized the lack of development in regime theory, which cannot account for the multi-level environment of water policy decision-making.

Governance

Governance theory is used by scholars within Public Administration to describe the framework of public institutions and their decision-making processes (Lynn, Heinrich, & Hill, 2002). The growth of governance as a theoretical construct evolved as government reforms took hold across many countries (Hill & Lynn, 2005). Lynn et al. developed a definition of public governance that is defined as "regimes of laws, rules, judicial decisions, and administrative practices that constrain, prescribe, and enable the provision of publicly supported goods and services through formal and informal relationships with agencies in the public and private sectors" (Lynn, Heinrich, & Hill, 2001).

The definitional components of public governance exhibit similar traits to institutions described in the literature of Institutional Economics and International Relations. Both concepts, institutions and governance, include three similar components:

1. A system of laws or rules that guide and frame the institutional environment;
2. A policy process to establish rules, laws, and objectives of institutional actions; and
3. A multi-level, hierarchal system of organization and actors that is responsible for guiding and implementing decisions through some type of ordered structural arrangement.

These three attributes are a common theme across institutional and governance research.

Empirical Studies of Institutions

The literature on Institutional Economics and International Relations is ripe with empirical studies on institutions (Saleth & Dinar, 2004). Saleth and Dinar provide a comprehensive overview of the variety of empirical studies (Alston, Thrainn, & North, 1996; Elinor Ostrom, 1991, Acheson, 1994; Clague, 1997; Cook & Levi, 1990). These studies focus on the broader applications of institutional economics. Saleth and Dinar also provide an extensive summary of empirical research on water institutions. Most prominent are the works of Le Moigne (1994), Ostrom (1991), and Picciotto (1995).

Within the United States, the National Research Council (NRC) has stated that more research is needed on water institutions (Blomquist, Heikkila, & Schlager, 2004). In response to the NRC's request, Blomquist et al. provided recommendations for institutional research in water resources. Specifically, they identified the need for more work on comparative institutional analysis. They suggest four primary areas for further research: the relationship between water law and policy outcomes, organization fragmentation with respect to water management, user-created organizations, and water-user participation

Blomquist et al. suggest that comparative empirical work is needed on water law. This work should examine the relationship between different property rights systems and water management practices. For example, adoption of a water management system of integrated water resource management may be unsuccessful in a rigid property rights system, such as prior appropriation.

Fragmentation of organizations is another area ripe for further study. The management of water is divided between levels of government and functional specialization (e.g., water supply, water pollution, or drought management). The multiple levels of organizations and the overlap between management responsibilities are often identified as

inefficient (Loucks, 2003; Stakhiv, 2003). Additional empirical work to examine how water institutions address different functional specializations would benefit water professionals.

Blomquist et al. conclude their recommendations by suggesting that existing frameworks for institutional analysis are sufficient. Future work on water institutions should use these frameworks while remembering that the frameworks interact with the public policy process. The roots of policy analysis inform researchers that multiple decision points or stages exist within the policy process. These decision points include but are not limited to problem definition, policy formation, agenda setting, implementation, and evaluation (Sabatier, 1991).

Policy Process

A simplistic but succinct view of the policy process is the stages model that exists within the policy process. The stages model suggests distinct phases in the policy process that occur in a cycle: problem identification, policy decision, implementation, and evaluation (Easton, 1965; Lasswell, 1956). The simplicity of the model is often criticized for its inability to accurately portray the complexity of the policy process and its inherent rationalistic approach to analysis (Lindblom & Woodhouse, 1993; Nakamura, 1987; Sabatier & Jenkins-Smith, 1993; Stone, 1989). Despite these criticisms, the stages model is still widely used in textbooks related to the study of public policy (Hill & Hupe, 2009).

The field of Policy Science as envisioned by Laswell (1956) was to develop rigorous study of the various components in policy making in an effort to bring a better understanding of the mechanism and pathways necessary to achieve desired policy outcomes. Water institutions are intertwined within the policy process at all stages of policy making. While not absolute, water politics and water policy are most involved in the phases

of policy formation and selection. Water administration is most involved in policy implementation.

Policy Implementation

The study of policy implementation does not have single theory or framework for guidance, but it is an area of significant importance for understanding the process from policy formation to policy output. Hill and Hupe (2009) provided an extensive review of the development of policy implementation research and its changes over time. Most scholars attribute the focusing event of implementation studies as Pressman and Wildavsky's text *Implementation* (Goggin, 1990). Early research focused on debates between competing viewpoints of "top down" and "bottom up" analyses to determine which level of governance had the most effect on policy outcomes. The debate included numerous studies of different independent variables of significance and inconsistent definitions of policy outcomes and outputs.

O'Toole (1993), Matland (1995), and Goggin (1990) offered critical reviews of early implementation studies. O'Toole identified over three hundred different independent variable used in implementation studies with little consensus in research findings. Goggin argued that a more rigorous approach was needed to develop a consistent theory of implementation. Matland added to the debate by suggesting that imposing a structure or framework to the study of implementation could ameliorate the problem of too many variables.

Hill and Hupe (2009) suggest that the study of implementation has followed paradigm shifts similar to those experienced in Public Administration, from early formations as a "problem-solving paradigm" to the current state of the field as a "governance paradigm." Hill and Hupe characterize the governance paradigm for research in policy

implementation as a study "with explicit attention to action." The institutions within governance are the action centers for the policy process. O'Toole (1993) suggests that implementation studies need to take into account the multi-level nature of institutional environments in order to provide comparisons between institutional settings. An institutional setting can vary by constitutional system, public administration style, socio-economic regime, and implementation regime (Hill & Hupe, 2009). Hill and Hupe define the variations in institutional settings as "modes of governance," which describes the institutional operating environment present during policy implementation (Hill & Hupe, 2009).

Implementation Frameworks

The previously described institutional and governance frameworks have several common themes: rules, institutional components, and exogenous influences. Policy implementation provides a pathway to examine the exogenous influences and improve understanding of institutional design and performance. The performance of institutions is a result of the interaction between the exogenous influences and the institutions (Saleth & Dinar, 2005; Ostrom, 2005). As previously described in the introduction to this chapter, I propose that these exogenous influences are reduced to a two-dimensional policy implementation environment based on dimensions of policy values and policy knowledge.

The proposed framework derives from review of three key implementation frameworks: Hill and Hupe's (2006 and 2009) Multiple Governance Framework, Matland's (1995) typology for implementation studies, and Hoppe's (1989) types of policy problems. Each of these frameworks addresses components of policy implementation but does not look directly at linkages between implementation, institutions, and performance. I will

describe how my proposed framework improves on previous work and provides a working model for institutional analysis and performance.

Hill and Hupe proposed the Multiple Governance Framework (MGF) for studies of implementation. The MGF, as shown in Table 2.1 was developed to address three issues with previous implementation frameworks: multidimensionality of decision making, visualizing connections between actors and actions, and lastly providing a metatheoretical construct for theory formation.

Table 2.1 The Multiple Governance Framework

		Action Level		
		Trias Constitutive Governance	Gubernandi Directional Governance	Operational Governance
Action Scale	System Organization	Institutional Design Designing contextual relations	General rule setting Mission formulation	Managing trajectories Managing relations
	Individual	Internalization of values and norms	Situation bound Rule application	Managing contracts

Source: Adaptation of Hill and Hupe (2009: 128)

Hill and Hupe's framework provides for differentiation between the locus of implementation studies and focus of implementation studies. The action scale and action level dimensions assert that the locus and focus of policy action defines the actors involved and institutional level of action.

Figure 2.2 The institutional levels of action.

The dimension of action level illustrates three Institutional levels illustrated in Figure 2.2. These levels are spheres of influence nested within each other with constitutive governance at the core and moving outwards towards operational governance. Constitutive governance lies at the core because it provides the foundation of institutional rules and norms that govern all other actions. Operational governance is the largest sphere to reflect the most frequent daily institutional actions.

Action scale identifies the institutional actors responsible for governance actions. Both individual actors and organizational actors make decisions that contribute to success of policy actions. Hill and Hupe's dimensions are insightful for examining elements at work internal to the implementation process. The dimensions describe governance actions at work

between the dimensions. The framework does not provide insight into how the factors at the action level and action scale contribute to institutional performance.

Matland (1995) developed an Ambiguity-Conflict matrix for implementation studies that moves closer to building an implementation framework that provides conditions for institutional performance. Matland's typology was an effort to reconcile debate in early implementation studies about the importance of bottom-up or top-down influence in policy implementation. His framework was an effort to provide a structure in which top-down and bottom-up approaches could both be utilized. The framework also was proposed to compile the key implementation variables into key factors affecting both top-down and bottom-up approaches.

Matland's (1995) framework suggests that policy implementation environments are classified based on levels of policy ambiguity and policy conflict. He chose ambiguity and conflict as the key implementation variables because they represent key attributes in policy decision-making (Matland, 1995). The selection of conflict as a key variable in implementation is reflective of two distinct theories on political decision-making: rational politics and bureaucratic politics. He uses this approach to account for variation in implementation environments that reflect decision-making based on goal agreement (Rational Model) and conflicting goals (Bureaucratic Model).

The second dimension of Matland's framework is policy ambiguity. He suggests that policy ambiguity within implementation be described as ambiguity of goals and ambiguity of means. The ambiguity of goals is reflective of a policy process that can at times produce policy with conflicting or vague goals. The lack of goal clarity is suggested as a tool for building consensus and support for policy action. A policy with a clearly specified goal will have a greater likelihood for conflict within the policy process. Matland and others suggest

that policy ambiguity with respect to goals and means is a natural feature of the political process. The combination of Matland's implementation dimensions yield the ambiguity conflict model shown in Table 2.2.

Table 2.2 Matland's Ambiguity-Conflict Matrix for Policy Implementation Process

		Conflict	
		Low	High
Ambiguity	Low	*Administrative Implementation* Resources	*Political Implementation* Power
	High	*Experimental Implementation* Contextual Conditions	*Symbolic Implementation* Coalition Strength

Source: Adaptation of Matland (1995: 160)

Matland's framework yields four modes of implementation: administrative implementation, political implementation, experimental implementation, and symbolic implementation. Within Administrative Implementation, rational decision-making is the governing process. Policy outcomes are largely dependent on having sufficient resources to solve the problem. Political Implementation environments are governed by a political decision making process. The policy outcome is largely dependent on the power of the actors involved. Experimental Implementation environments are ill-defined and governed by contextual conditions. Matland defines contextual conditions as variations in resources and actors in the "micro-implementing environment" (Matland 1995, 166). The policy outcome will vary depending on the extent of participation of various actors and the resources

provided. Lastly, Symbolic Implementation environments are similar to Political Implementation environments, but policy outcomes are dependent on coalition strength. Coalition strength suggests that power affecting policy outcomes is derived at the micro level as opposed to the macro level.

Matland's implementation model yields insight into the types of institutional structures that are necessary during implementation. The model also suggests inputs necessary for different implementation environments. Although, the model recognizes uncertainty during policy implementation, the ambiguity dimension does not address the contributing factors to uncertainty that contribute to the performance of institutions during implementation. These factors are directly linked to complex policy problems and policy action (Koppenjan and Kijlin, 2004).

Policy actions are efforts by institutional actors to address policy problems. Hoppe (1999) developed a taxonomy of policy problems on dimensions of knowledge certainty and agreement on problem definition. Hoppe's dimensions result in four types of policy problems shown in Table 2.3.

Table 2.3 Hoppe's Four Types of Policy Problems

		Certainty on Scientific Knowledge	
		Large	Little
Societal Agreement on Problem Formulation	Large	*Technical Problems*	*Untamed Technical Problems*
	Little	*Political Problems*	*Wicked Problems*

Source: Adapted from (Koppenjan and Kijlin, 2004, 29)

Koppenjan and Kijlin (2004) assert that solutions to policy problem solving are structured to transform policy problems into technical problems. Technical problems are similar to Matland's category of administrative implementation. Within this realm institutions' primary constraint to addressing policy problems is one of resources. However, very few policy problems or implementation environments fall into this realm. Knowledge conflicts are more common even when societal agreement may be large (Hoppe, 1999). Koppenjan and Kiljin discuss that many policy problems take on the form of wicked problems as a result of uncertainty in the policy environment.

The presence of uncertainty makes viable policy solutions extremely complex. Uncertainty arises for institutional actors when knowledge of a policy's impact on the problem is lacking. This uncertainty takes three primary forms: substantive, strategic, and institutional. Substantive uncertainty is lack knowledge about the problem and/or lack of information at the time policy action is taken. Strategic uncertainty reflects the lack of ability to clearly predict institutional actors choices and the interaction of these choices. Institutional uncertainty results from policy actions requiring participation from multiple institutions. Each institution has its own respective rules, preferences, language, and goals.

Hoppe's problem types, along with Koppenjan and Klijn's discussion of uncertainty, further clarify implementation factors that affect the performance of institutions. Hoppe's problem definitions suggest that institutional performance is strongly associated with type of policy problem. Technical problems should have a high solution rate and positive institutional performance. Wicked problems are unlikely to be solved and are subject to iterative problem solving in a complex institutional environment. The uncertainty associated with the wicked problems is largely the result of several factors, including intertwinement of institutions, knowledge development, and value pluralism (Koppenjan and Kijlin, 2004).

Koppenjan and Kijlin suggest that value pluralism is the result of the networked nature of present society. Values systems exist at the individual and organizational level. These values can be divergent and competing, while changing over time. They also assert that knowledge development contributes to uncertainty in the environment. Knowledge development makes individual and organizations more aware of the complexities inherent in problem solving. The complexity leads to competing conclusions of scientific and objective research. The nature of value pluralism and knowledge development within public policy suggests that consensus for policy action requires a network approach (Koppenjan and Kijlin, 2004).

Koppnejan and Kijlin develop a network approach for addressing wicked problems. They argue that the networked approach is superior for wicked problem solving, given the complexity of the problem and the mutual dependency of the institutional actors. Institutional actors within this implementation environment must address substantive uncertainty, strategic uncertainty, and institutional uncertainty. Substantive uncertainty is attributable to lack of complete information about the problem, either due to unavailability or competing interpretations of information. Strategic uncertainty results from the complex nature of institution and its actors' inability to accurately predict each other's actions. Institutional uncertainty results from the inability of institutional actors to decipher outcomes of interactions between institutions.

These types of uncertainty arise among actors both within institutions and across institutions. Uncertainties at multiple levels within an implementation environment indicate that some level of consensus on policy values and policy knowledge is necessary for policy action. Otherwise strong political actors or coalitions will be necessary to overcome lack of consensus.

The previous frameworks for multigovernance, implementation, and problem solving consistently identify actors, information, and decision-making processes as core components of implementation environments. Hill and Hupe use actors and level. Matland uses ambiguity and conflict. Hoppe uses knowledge and agreement. Koppenjan and Kijlin use uncertainty of values and information. Each of these factors is critical to institutional performance.

Working Model

My proposed Implementation Framework for Institutional Analysis (IFIA) builds on the previous frameworks by focusing on a key attribute in the policy process: level of agreement. At the root of policy decisions and actions are institutional actors' level of agreement on knowledge and values. I use the term agreement because agreement is necessary for action. Matland recognizes two types of decision making in an implementation environment: rational decision-making and political decision-making.

Rational decision-making is easily attributable to individual actors. An individual actor must only reach agreement with himself or herself to take action. The rational model is an appropriate basis for decision-making, such that individuals make choices of action based on an their internal knowledge of the action's anticipated results and prioritization of individual values. Likewise, a similar process exists for collective action between multiple actors where agreement exists on knowledge of the action's anticipated impacts and agreement on prioritization of values.

Political decision-making is applicable to disagreements in decision-making. Matland suggests that the conflict model is appropriate under these situations. Deborah Stone makes a stronger argument that political decision making is reasoning based on metaphor and analogy—persuasion instead of rationale process (Stone, 2002). This type of decision-making

is based on the conflict of ideas, in which actions are iterative attempts to specify goals, identify problems, and create solutions. Solutions under Stone's framework are actions to address societal behavior. The actions include: inducements, rules, facts, rights, and powers.

Both forms of decision-making are present within an implementation environment. Within public institutions a consistent question is how this decision-making is used to make an effective choice among alternatives when uncertainty is present (Dahl, 1957; Stone, 1997). Dahl uses the example of the United States Supreme Court as an arbitrator of facts and values, where disagreements between extremely knowledgeable parties exist. He argues that the decision-making performed by the court is policy setting and not simply a legal process. This decision-making, choosing between alternatives based on facts and values, is at the core of the policy implementation process. Facts are inconsequential as standalone pieces of data. The organization and compilation of these facts into a knowledge base to assess impacts of policy actions is more critical to decision-making than facts alone. Values are inherent both within the individual and organizations and they are used in both individual and collective action.

I argue that agreement on values and knowledge are the critical factors affecting implementation environments. I propose a more parsimonious specification to my previous framework described at the beginning of this chapter to reduce implementation environments to two dimensions, as shown in Table 2.4.

Table 2.4 Implementation Framework for Institutional Analysis (IFIA)

		Knowledge Agreement on Policy Action Impacts	
		High	Low
Value Agreement on Policy Action	Concentrated	*Administrative Institutions*	*Political Institutions*
	Dispersed	*Networked Institutions*	*Symbolic Institutions*

The theoretical power of the framework provides a mechanism to investigate the exogenous factors affecting institutional performance while affording integration with current models of institutional analysis. The framework is parsimonious because it focuses on the primary interaction between knowledge and values within decision-making regardless of institutional actor or institutional level. The framework is applicable to individual actors, organizations, and all governance levels.

Administrative Institutions operate in an implementation environment of concentrated agreement on values and high agreement on knowledge of policy impact. This environment consists of concentrated groups of institutional actors with agreement on policy values. The concentrated level of agreement reflects two cases. The first case is a powerful group of institutional actors that assert their values despite protest from competing actors. The second case is a group of institutional actors with concentrated agreement on policy values that lack opposition from other institutional actors. The high level of agreement on knowledge of policy action impacts is broad and results in less conflict on policy action than the political institution environment. In such cases, the performance of institutions will be good.

Political Institutions operate in an environment of concentrated agreement on values and low agreement on knowledge of policy impact. This implementation environment results from a concentrated group of institutional actors with shared values and political power. The actors are able to initiate policy action despite conflicts in knowledge of policy impacts and lack of consensus on policy values. Any successful performance of institutions in this environment will exist only as long as political power does not change.

Networked Institutions operate in an implementation environment of consensus agreement on values and high agreement on knowledge of policy impact. Within this implementation environment a broad spectrum of institutional actors are aligned with the policy values and in agreement on the impacts of the policy action. These implementation environments will result in the best institutional performance.

Symbolic Institutions operate in an implementation environment of consensus agreement on values and low agreement on knowledge of policy impact. These are environments in which institutional actors have consensus that a policy problem exists but are not in agreement on the appropriate policy to address the problem. The implementation environments are expected to result in poor institutional performance.

Theoretical Justification of Implementation Dimensions

I assert that the dimensions of policy values and knowledge of policy impacts represent the primary influences at work during policy implementation. As described in the previous implementation frameworks, institutions operate in implementation environments that represent different levels of agreement on knowledge and values. The degree of agreement on these two dimensions is reflective of decision making at the individual or

institutional level. My assertion for these dimensions derives from early arguments on the nature of public administration (Dahl, 1947; Simon, 1947; Waldo, 1948).

At the heart of these arguments is the role of public administration within the political process. My framework does not take up the debate on the role of public administration. The framework asserts that implementation of political decisions are subject to the dimension of institutional actors agreement on policy values and knowledge of policy impacts. These dimensions reflect the decision making among multiple levels within and across institutions under different implementation environments.

An immediate criticism of my framework could be that the proposed factors are endogenous to the structure of institution. The endogeneity question of policy implementation's role in the policy process is a core weakness with implementation studies. Despite the criticism, institutional research supports my proposition that the factors are exogenous. An examination of current frameworks of institutional analysis provides consistent support for knowledge and values as instrumental to institutional design and performance.

Ostrom (1994) developed the Institutional Analysis and Decomposition Framework (see Figure 2.3) to specify the relationship and attributes at work within institutional action.

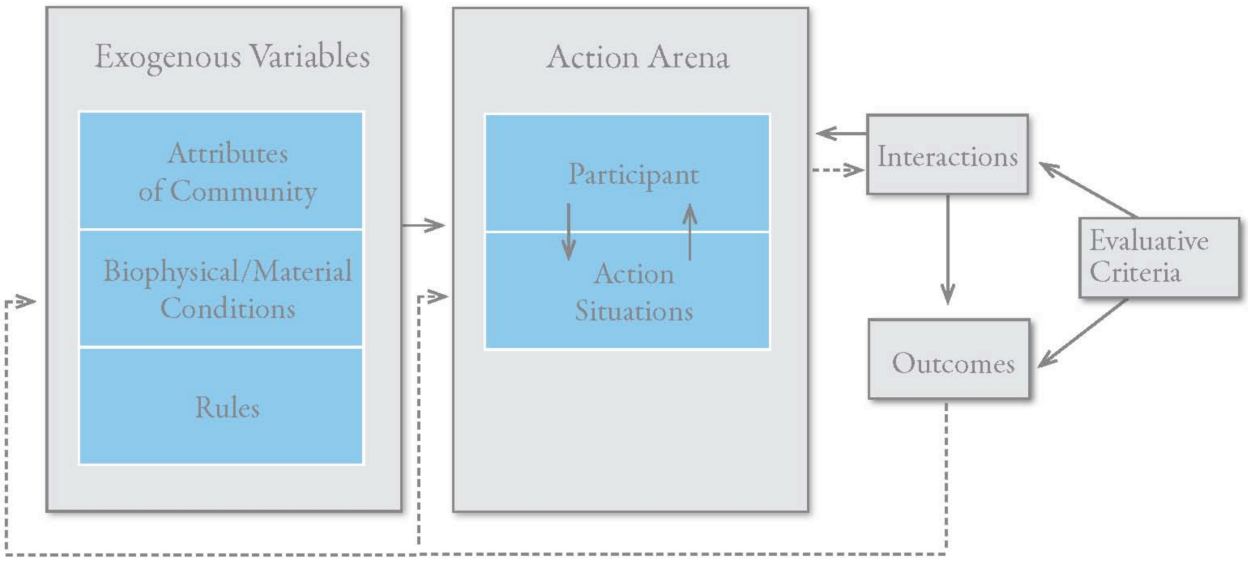


Figure 2.3 The institutional analysis and development framework.
Source: Adapted from Ostrom, 2005 pg 15.

Ostrom's framework converts institutional action to dependent variables subject to influence from the exogenous variables on the left side of the action arena and also influenced by linkages to other action arenas. The framework's power is the metatheoretical construct created for institutional analysis.

The exogenous variables of biophysical/material conditions and attributes of community represent the implementation environment at work for the action arena. The rules serve at multiple levels and are the key issue in asserting the implementation environment as exogenous with respect to institutional performance. Ostrom's level of analysis suggests that rules are derived by interaction of action arenas and the other exogenous variables at the metaconstituional level (Ostrom, 2005, page 21). Once the rules are established they become an exogenous variable for analysis of remaining institutional levels.

The proposed IFIA dovetails nicely with the IAD Framework and improves on interpretation of community and biophysical attributes. The IFIA fills a gap to link institutional analysis to the larger policy environment. The IFIA also provides a mechanism to assess institutional performance and assess how knowledge and values affect decision-making at individual and collective levels within institutions. These dimensions of knowledge and values reduce community and biophysical attributes to discrete and transferable concepts. Ostrom defines the important factors within community as the values, level of common understanding, homogeneity of preferences, size and composition, and extent of inequalities of basic assets. Of these attributes, shared values are critical to the success of repeat interactions among institutional actors. My proposed framework utilizes the level of agreement on values as a critical factor for determining institutional performance.

Ostrom describes the biophysical and material conditions as "events or goods and services being produced, consumed, and allocated in a situation as well as the technology available for these processes" (Ostrom, 2005 page 17). It is not the physical element of these conditions that are important to the implementation environment. More important is the institutional actors' knowledge of how the biophysical and material conditions will shape the desired policy outcome. The IFIA improves on Ostrom's variables by identifying the root action at work in the implementation environment. This root action is the level of agreement on knowledge of how the policy action will impact the desired policy outcome. This knowledge is explicitly derived from institutional actor's knowledge of how the biophysical/material condition attribute can be transformed into a desired outcome.

Saleth and Dinar expanded upon Ostrom's IAD framework in effort to better understand the structural interaction between institutional components for comparative analysis of institutional performance. Their framework is called the Institutional

Decomposition and Analysis Framework (IDA). The IDA is used to separate institutions or the structure of action arenas into three components: administration (administrative or organization rules), policy (policy guidance), and law (constitutional rules). The purpose of their framework is to further decompose institutional structure and separate the structure from exogenous influences of the larger institutional environment. Figure 2.4 illustrates the IDA overview of exogenous influences on institutional performance.

Similar to Ostrom's exogenous variables, Saleth and Dinar's exogenous influences can be reduced to the two dimensions of knowledge and values. Their variables of Political System, Legal System, and Demography are similar Ostrom's variable of Community and my dimension of policy value. The system of politics, law, and society are reflections of individual and collective values. The economic policies and resource/environment are similar to the Biophysical and Material conditions from Ostrom's work and transfer to my dimension of knowledge of policy impact.

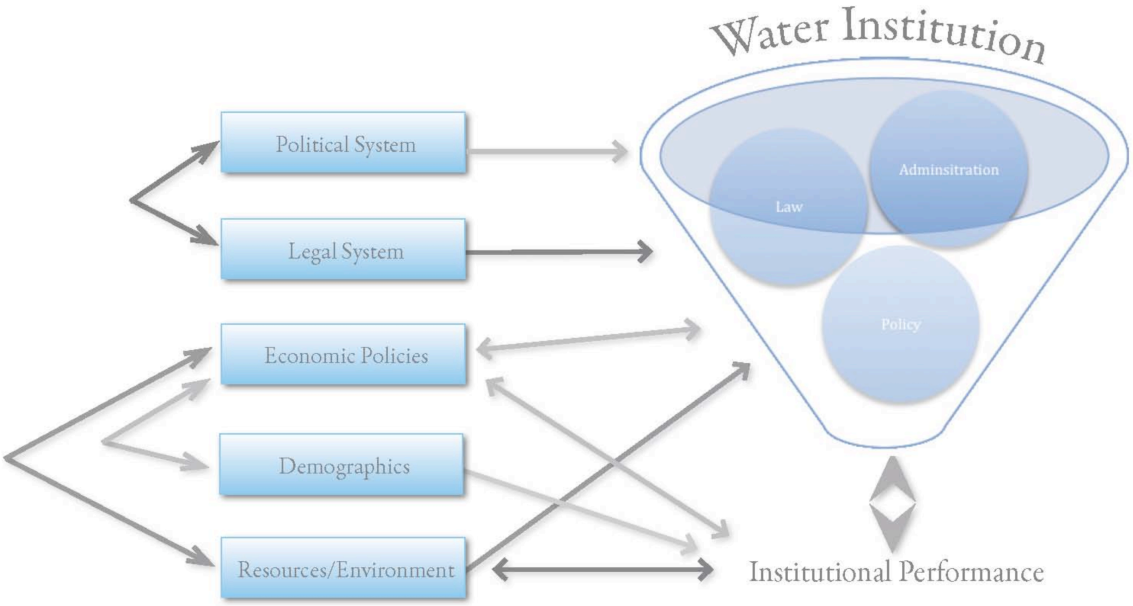


Figure 2.4 Exogenous influences on institution-performance interaction.
Source: Adapted from Saleth & Dinar, 2004, pg 102

Saleth and Dinar's framework was developed specifically for analysis of water institutions. Ostrom's work has large traction on institutions associated with common pool resource, as well as other types of institutions. The proposed implementation framework for institutional analysis has broad applicability to all institutions. The focus for this dissertation is examination of institutions dealing with public policy problems. Next I apply the framework to several case examples to demonstrate the broad applicability.

Case Examples

Example of Administrative institutions: Drought management

Within the current global society, very few policy problems result in administrative institutions. Drought management planning is a dry topic that often results in administrative institutions. Reforms to the state of Georgia's drought management plan in 2008 provide a working example of an implementation environment for administrative institutions.

As a result of the 2007 southeastern drought, the State of Georgia revised the state drought management plan. The revisions were necessary to address impacts to the landscape industry. Drought management plans define water allocations dependent on drought intensity. The restrictions on outdoor watering during Georgia's drought severely impacted the landscape industry (Flanders, 2007).

The existing drought management plan combined with resource information reflects a unified agreement on knowledge of policy impacts. The plan specifies priorities of water allocation under different drought levels. The decision to amend the plan to incorporate provisions for landscape industry reflects concentrated policy values for protecting private enterprise under conditions of resource scarcity. The decision to amend the plan received little public opposition (Bluestein, 2008). The lack of opposition reflects an implementation

environment of low conflict despite presence of value differences. This fact is important because concentrated values may be unopposed during implementation or highly contested.

Example of Political Institutions: U.S. Health Care Mandate

The Supreme Court of the United States recently upheld provisions of individual mandate that was included in the Affordable Care Act of 2009 (Matthews, 2012). The individual mandate requires all U.S. citizens to obtain health insurance by 2014. The mandate was subject of contentious debate of the role of government and its impact on society.

The health care mandate results in a political institution because of the severe disagreement on knowledge of policy impacts and intense level of concentrated policy values. Public opinion polls show only forty seven percent support the mandate (Sargent, 2012). Support for the mandate is rooted in policy values of public intervention to solve a policy problem. Unlike uncontested concentrated policy values in the previous description of drought management, the mandate has strong opposition from stand-alone market solutions. This policy also has strong levels of disagreement on the knowledge of policy impacts. Policy analysts have competing views on the cost implications of the mandate and its ability to reduce future health care costs (Higgins and Heath, 2012).

Given the contentious nature of policy values and policy knowledge, the implementation environment will need strong political power to achieve desired policy outcomes. This fact is evident by the recent challenge of seven states to repeal the mandate as unconstitutional. Time will tell which predictions on the policy impacts are correct.

Example of Networked Institutions: Clean Water

Passage of the 1972 Clean Water Act was a major milestone for water institutions. The Clean Water Act was a comprehensive policy by the United States to protect water form existing and future threats. The passage of this act is reflects the implementation environment of a networked institution. The act defined the processes for regulating pollutant discharges, procedures for development of water quality standards, define

The policy values at work that led to passage of the act varied among institutional actors. The pro-environmental movement saw the act as resource protection. The regulated environment, saw clarity of process regarding environmental regulations and enforcement.

Agreement on the knowledge of policy impact was large. The reasons for agreement on the policy impacts of the clean water act were due to the procedural substance of the act. Stakeholders within the process know that the immediate policy outcome would develop over time.

Example of Symbolic Institutions: Climate Change

Debates on global warming reveal deep disagreements on cause and effect and relevancy of the problem. Discussion on global warming includes input from multiple stakeholders that transcend national borders and institutional levels. Subsequently, policy efforts such as the Kyoto Protocol, have not succeeded in any unified institutional efforts to address climate change.

The Kyoto protocol is representative of a symbolic implementation environment. Without a consensus agreement on the impacts of the protocol and multiple values at work, the policy has had mixed results (Oberthur and Ott, 1999). Member countries that signed the accord have reduced CO_2 emissions, but concerns of climate change are ever present. The Institutional environment is largely symbolic. It consists of loose connections between

institutions working in fragmented network. Without stronger consensus on the policy values or larger agreement on the policy impacts, the protocol is ineffective.

Conclusion

I suggested at the outset of this chapter that implementation environments are critical factors that effect institutional performance. I have shown how most institutional frameworks identify implementation factors as exogenous variables without sufficient detail to describe their contribution. By reviewing previous work on policy implementation and institutions, considering the important role of decision-making, the proposed framework provides a sound approach to institutional analysis and performance. The proposed Implementation Framework for Institutional Analysis sheds light onto the role values and knowledge play on institutional performance. The interaction of these two dimensions yields institutional typologies with different performance expectations. Further examinations of these typologies produce testable predictions for institutional performance.

Finally, while I have asserted that the framework yields four different implementation environments, the model allows for institutional change and development as policy values and knowledge change. This flexibility allows for convergence on both knowledge and values to recognize changes in the policy environment. An institution can shift form symbolic with poor performance to a networked institution s consensus is reached on policy knowledge. The framework provides a guide for institutional research. Next I will provide quantitative support for the proposed framework through examination of institutional data.

CHAPTER 3

Water Institutions: An Implementation Perspective

Introduction

The importance of policy implementation has mostly been overlooked in research on the performance of water institutions. I propose to bridge the gap between implementation theory and institutional design through the Implementation Framework for Institutional Analysis described in the previous chapter. The framework expands the discussion of factors contributing to the performance of water institutions. Success in addressing problems of water scarcity is heavily intertwined with the design of water institutions. National governments and international organizations all echo this sentiment. The Global Water Initiative, an organization comprised of seven major aid organizations, lists institutional interventions as part of its core approach:

> The success of water and sanitation interventions in small geographic areas very much depends on an enabling policy environment at local, regional, and national levels. This includes forums to bring together different actors to debate, discuss, and promote awareness of water use. It calls for policies at local and national level that support equitable and sustainable water use and are well integrated with other sectors. Even at the community level, an enabling environment for effective governance is needed with clearly understood and accepted roles, responsibilities, and bylaws.[2]

Similarly, the United Nations Development Programme lists governance failure as the primary cause of lack of access to water and sanitation.[3] Changing water institutions to

[2] http://www.globalwaterinitiative.com/index.php/our-approach/

[3] While there are regional/local and long-term concerns about the absolute availability of water resources, the water and sanitation crisis is primarily a crisis of poverty, political will, inequality, and power – in short, of profound failures in water governance. http://www.beta.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/water_and_ocean_governance.html

address water policy issues is critical, but the institutional changes needed are directly linked to the policy implementation environment.

In this chapter I provide quantitative validation of the relationship of implementation environments to institutional typologies through use of confirmatory factor analysis. The theoretical underpinning of the framework described in chapter two is tested on cross-country water institution data collected by the World Bank. Using the Implementation Framework for Institutional Analysis, I confirm the importance of policy values and knowledge of policy impact as two variables influencing institutional design.

The Implementation Framework for Institutional Analysis uses the dimensions of Value Agreement on Policy Action and Knowledge Agreement on Policy Action Impacts for assessing implementation environments. The implementation environments correspond to four different types of institutional operating paradigms. The IFIA matrix asserts that the alignment between operational paradigms and implementation environments will increase likelihood of achieving proposed policy outcomes. This assertion is supported in the findings and provides critical insight into dimensions contributing to institutional performance. Policy Implementation environments directly contribute to the performance of institutions. The IFIA provides a mechanism to measure the relationship. Table 3.1 provides an overview of framework.

Table 3.1 Implementation Framework for Institutional Analysis (IFIA)

		Knowledge Agreement on Policy Action Impacts	
		High	Low
Value Agreement on Policy Action	Concentrated	*Administrative Institutions*	*Political Institutions*
	Dispersed	*Networked Institutions*	*Symbolic Institutions*

While the typologies are static, institutions are dynamic and likely to be shifting through each typology over time. Figure 3.1 is a graphic representation of the continuous progression of institutional change as constituent agreement and certainty of policy action changes over time. The change in institutions is gradual and occurs over time.

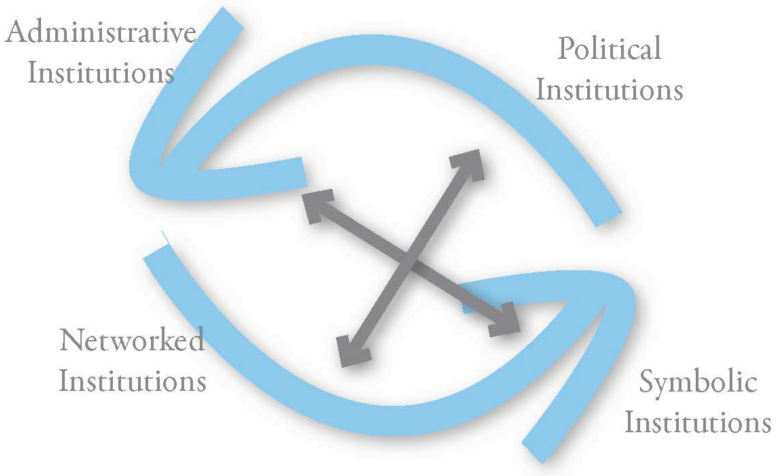


Figure 3.1 Institutional change over time.

A Policy Implementation Approach to Institutional Analysis

The success of institutional goals is directly related to policy implementation (Pressman, Wildavsky, & Oakland Project, 1973). Pressman and Wildavsky's seminal study on policy implementation identified that, even with consensus on policy objectives and prescriptions, the success of achieving desired policy outcomes is dependent on the implementation environment. Within the context of water institutions, an implementation perspective is equally applicable for understanding institutional performance.

During the initial period of implementation research, there was much debate on key variables and analytical approaches (Goggin, 1986; O'Toole, 1986; Sabatier, 1986). Early research argued that implementation was a top-down process driven by policy makers. Counter arguments were made for a bottom-up approach that suggested that street-level bureaucrats were critical to implementation success (Lipsky, 1980). Along with debate on the analytical approach, multiple variables were suggested as significant drivers to the implementation process (Goggin, 1986).

Despite these early obstacles, implementation research persisted and has renewed interest among policy and governance scholars (DeLeon & DeLeon, 2002; Hill & Hupe, 2003; O'Toole, 2000; Werner, 2004)about the role of policy implementation on governance. Earlier studies performed by Matland (1995), Hoppe (1999), Koppenjan and Kijlin (2004), and Hill and Hupe (2003) provided implementation frameworks for understanding key variables contributing to implementation environments. Building on previous implementation research, I propose the Implementation Framework for Institutional Analysis to narrow the focus to key variables influencing institutional performance.

What is Relevance for Water Institutions?

As referenced in the Introduction to this chapter, concerns about water scarcity drive questions of institutional performance, with institutional design as the key variable. However, North (1990), Saleth and Dinar (2000), and Schalger and Heikkila (2004) have all indicated that institutional design alone may not be sufficient to yield desired policy outcomes. The public nature of water policy can yield policy implementation environments that may be contrary to desired institutional performance. Therefore, an understanding of relationships between institutions and implementation environments is critical in developing successful water institutions.

Why Do Water Institutions Matter?

Water institutions provide governance frameworks that affect rules, decision-making processes, and administrative practices associated with water resource management. They are concerned with a range of issues, from water supply to water quality. In developed nations, water issues paradoxically range from lack of water supplies to support economic growth to water quality impacts from significant growth and development (Glennon, 2009; Trottier & Slack, 2004). In less developed countries (LDCs), collective governance between international and domestic water institutions has been unable to provide sufficient access to clean water despite years of large investments from public and private resources (Brichieri-Colombi, 2009; Iyer, 2007). The term "collective governance" describes shared arrangements for decision making between international, national, and sub-national organizations (Varady, Meehan, & McGovern, 2009).

Varady, Meehan, and McGovern suggest that the growth of collective governance, or global water initiatives, represents a paradigm shift for water institutions. The ability of water institutions to manage all of the different demands made on water resources is viewed

by many as the greatest global challenge for the next millennium (Bartram & Cairncross, 2010; Brichieri-Colombi, 2009; Gleick, 2009).

Traditionally, the responsibility for addressing water scarcity within water institutions has primarily been viewed as a technical problem to be solved by water professionals who are primarily engineers. This method of problem solving is attributed to a "hydrocentric" focus (Brichieri-Colombi, 2009; Varady, et al., 2009). Brichieri-Colombi argues that the hydrocentric focus leaves little room for alternative viewpoints that could lead to different policy solutions. His argument is that a hydrocentric viewpoint limits problems analysis to issues of water supply and water demand.

In addition to the traditional hydrocentric problem solving method of addressing water scarcity, water professionals have advocated for changes in operational delivery methods. This approach defines water as a commodity for market-based service provision (Meinzen-Dick, 2007). Under this approach, private provision of water is considered to improve economic efficiency and service provision (Bakker, 2003). The past decade has seen a growth trend in private investment into water and sanitation infrastructure as well as new forms of private and public-private provision of water (Bakker, 2003). Despite these changes, water scarcity problems still exist.

Privatization and improved technology, such as desalinization, fail to solve the problems of water scarcity due to policy prescriptions developed in a hydrocentric environment (Amery, 2000; Brichieri-Colombi, 2009; Iyer, 2007). Hydrocentric policy solutions often provide little insight into the relationship of policy processes and governance institutions (Conca, 2006). The current scholarship on water institutions views the inability of water institutions to adequately address water scarcity as a crisis of governance (Fischhendler, 2008). This crisis of governance is a result of fragmented institutions that are

incapable of making shared resource management decisions that are mutually beneficial to themselves and other institutions (Conca, 2006; Daoudy, 2008; Fischhendler, 2008). This dissertation seeks to explore an alternative view that hypothesizes that the crisis of governance may not be due to fragmentation. Instead, it may result from a mismatch between institutional or governance frameworks and policy implementation environments(Hill & Hupe, 2009).

Methodology and Data

Having outlined the basic features of implementation environments and their significance for water institutions, this chapter seeks to validate the two dimensional implementation environment of the Implementation Framework for Institutional Analysis based on confirmatory factor analysis.

Confirmatory factor analysis (CFA) is a suitable method for testing the proposed framework. The dimensions of policy values and policy knowledge are not directly observable. They are theoretically grounded and are similar to exogenous influences identified institutional analysis. CFA provides a statistical method to test relationships between observable variables and the proposed dimensions of policy values and policy knowledge. CFA is superior to exploratory factor analysis because it allows for specification and testing of models. The general equation for CFA models is

$$X = \Lambda\xi + \delta$$

where X is a vector of observed variables; ξ is a vector of proposed factors drawn from latent variables; Λ is a matrix of loadings of latent variables that gives the magnitude of the effects of ξ on X; and δ is a vector of measurement errors (Perry, 1996).

The proposed factors for the IFIA are knowledge of policy impact and agreement on policy values. I confirm the presence of these factors through examination of a dataset on water institutions that includes twenty-one variables representing core attributes of institutional design and performance. The dataset includes variables for three key institutional components: water law, water administration, and water policy (Saleth & Dinar, 2004). Saleth and Dinar derived these components based on their framework of institutional decomposition and analysis (IDA) for study of water institution performance. Figure 3.2 illustrates Saleth and Dinar's decompositions of the three institutional components.

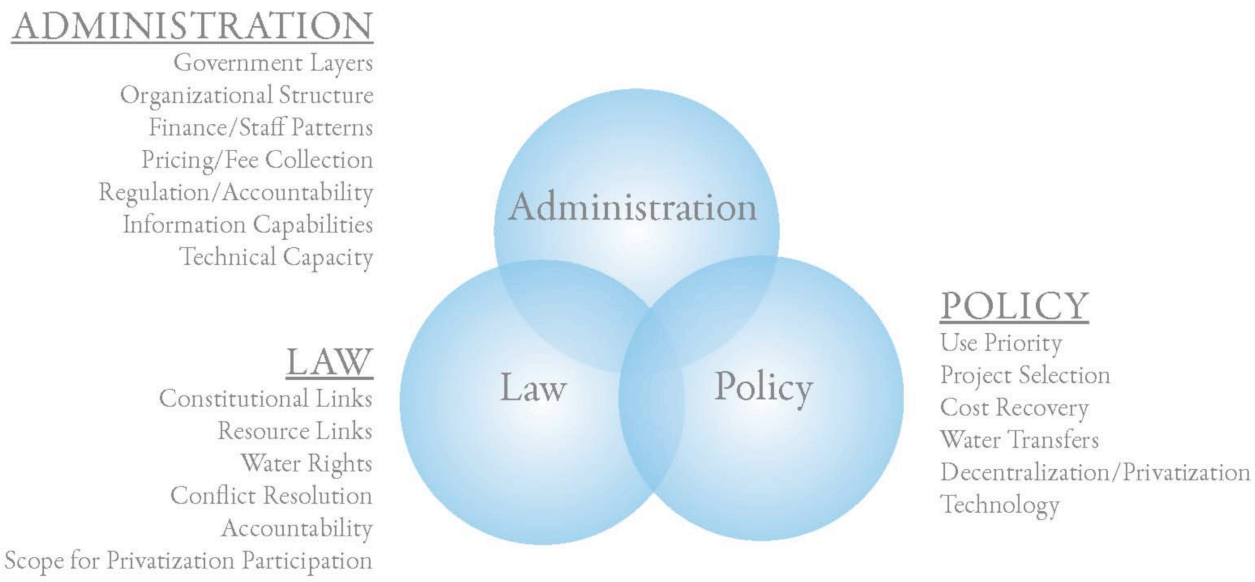


Figure 3.2 Core components of water institutions.

The sample dataset provided by Saleth and Dinar includes 127 observations on water institutions representing 39 countries and four states within the United States: California, Illinois, Texas, and Colorado. Saleth and Dinar included the same four states as representative samples of variations in United States legal traditions, institutional

arrangements, and water sector status (Saleth & Dinar, 2004). Data was collected for each area through a survey of 278 water experts during the period of 1997-2000. The survey had a response rate of 48%. The dataset provides rich perspectives on different countries, socio-economic conditions, and water resources. The countries and regions represent 52% of global land area and 68% of the population of the world in 2000 (Figure 3.3). Table 3.2 provides the socioeconomic profile and water sector features of the sample countries.

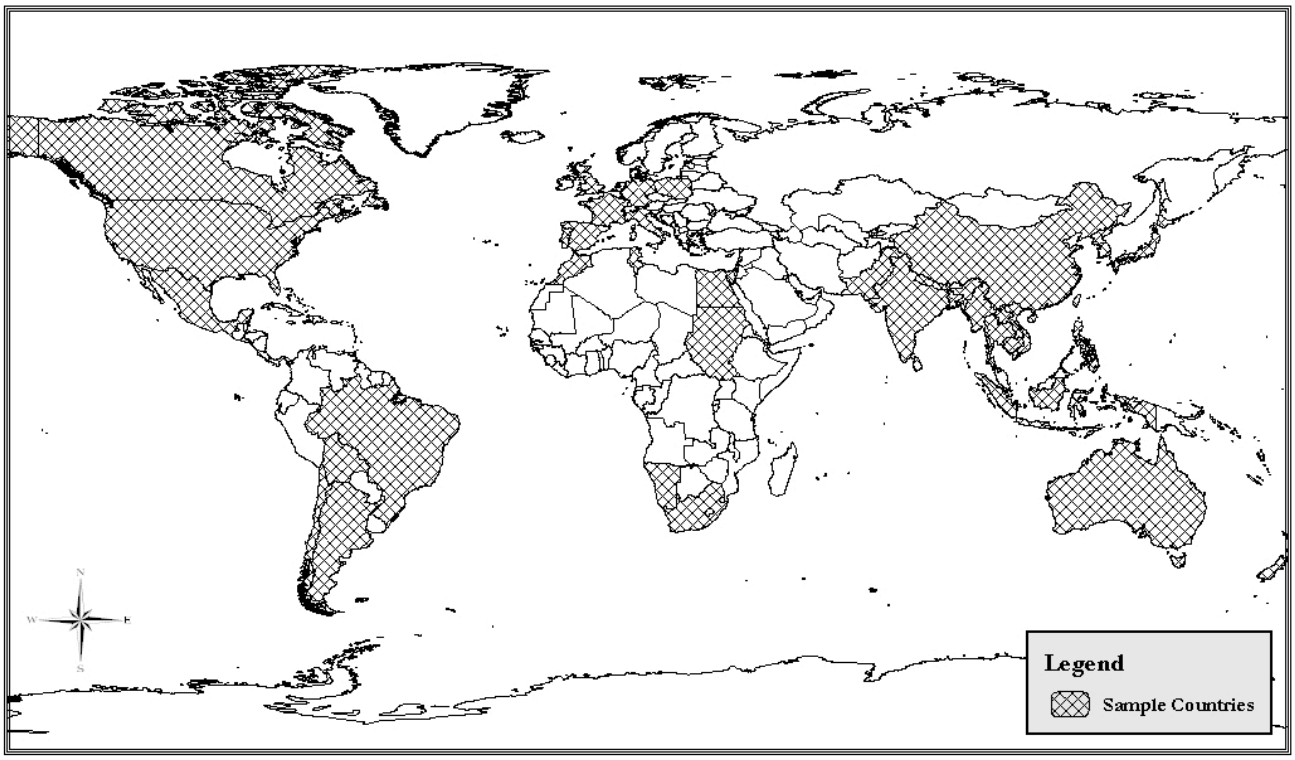


Figure 3.3 Map of sample data countries.

Table 3.2 Socioeconomic Profiles of Sample Countries

Country Name	Political Regime[a]	Population (million)	Area (million km^2)	Annual Rainfall (cm)	Renewable water resources (bcum)	Annual freshwater withdrawals, total (bcum)	Percentage used for agriculture	Freshwater Withdrawal per capita (m^3)	Arable land (hectares per person)
	(1997)	(2000)	(2000)	(2000)	(Various years)	(2000)	(2000)	(2000)	(2000)
Argentina	1	37	2.78	5.0 – 500.0	1031.01	32.6	66.1	882	0.76
Australia	2	19	7.74	12.7 – 127.0	356.76	23.9	75.3	1248	2.47
Bangladesh	1	129	0.14	101.6 – 203.2	1233.41	14.6	86.0	113	0.07
Bolivia	1	8	1.10	25.4 – 177.8	309.00	2.0	57.2	244	0.36
Brazil	3	174	8.55	60.0 – 360.0	7133.11	59.3	61.8	340	0.33
Cambodia	4	12	0.18	38.0 – 76.2	496.88	4.1	98.0	328	0.30
Canada	5	31	9.97	38.1 – 203.2	2856.40	46.0	11.8	1494	1.49
Chile	1	15	0.76	5.0 – 20.0	480.11	11.3	70.3	735	0.11
China	6	1262	9.60	12.7 – 76.2	2856.25	525.5	77.0	416	0.10
Egypt	1	68	1.00	5.0 – 20.0	58.84	68.2	86.4	1008	0.04
France	1	61	0.55	63.0 – 140.0	191.51	31.8	12.3	523	0.30
Germany	3	82	0.36	50.0 – 250.0	177.86	46.3	16.0	563	0.14
India	3	1054	3.29	13.0 – 1100.0	1943.11	610.4	91.5	579	0.15
Indonesia	1	213	1.91	100.0 – 500.0	2613.38	113.3	81.9	531	0.10
Israel	1	6	0.02	2.5 – 35.5	1.10	1.7	64.0	270	0.05
Italy	1	57	0.30	76.2 – 127.0	168.72	45.3	44.1	796	0.15
Japan	7	127	0.38	76.2 – 203.2	432.05	88.4	62.5	697	0.04
Korea, Rep.	1	47	0.10	130.0	70.55	23.7	63.0	504	0.04
Lao PDR	6	5	0.24	110.0 – 370.0	283.19	3.0	90.0	564	0.17
Mexico	8	99	1.96	15.0 – 170.0	463.56	77.8	78.0	778	0.25
Morocco	7	29	0.45	12.7 – 76.2	30.04	12.6	87.4	437	0.31

Country Name	Political Regime[a]	Population (million)	Area (million km^2)	Annual Rainfall (cm)	Renewable water resources (bcum)	Annual freshwater withdrawals, total (bcum)	Percentage used for agriculture	Freshwater Withdrawal per capita (m^3)	Arable land (hectares per person)
	(1997)	(2000)	(2000)	(2000)	(Various years)	(2000)	(2000)	(2000)	(2000)
Myanmar	9	45	0.68	76.2 – 127.0	1058.18	33.2	89.0	739	0.22
Namibia	1	2	0.82	5.0 – 70.0	54.75	0.3	71.0	158	0.43
Nepal	10	24	0.15	100.0 – 400.0	211.58	10.1	97.6	412	0.10
Netherlands	3	16	0.04	62.5 – 92.5	92.75	7.8	34.0	490	0.06
New Zealand	10	4	0.27	60.0 – 150.0	344.21	2.1	42.2	547	0.39
Pakistan	1	145	0.80	30.5 – 162.5	261.63	172.6	94.3	1194	0.15
Philippines	1	77	0.30	236.0	338.26	55.4	88.0	717	0.07
Poland	10	39	0.32	60.0 – 100.0	63.53	13.1	10.3	341	0.36
Portugal	1	10	0.09	50.0 – 100.0	72.73	11.9	74.2	1162	0.16
South Africa	1	44	1.22	5.1 – 134.6	50.74	12.5	62.7	284	0.33
Spain	11	40	0.51	15.2 – 139.7	111.03	37.1	65.1	922	0.33
Sri Lanka	1	19	0.07	30.4 – 233.7	44.25	13.0	92.2	694	0.05
Sudan	9	34	2.38	70.0 – 100.0	31.15	37.1	97.1	1086	0.48
Thailand	4	63	0.51	127.0 – 230.0	415.28	33.1	91.0	524	0.25
Tunisia	1	10	0.16	10.0 – 25.0	3.95	2.8	86.0	293	0.30
United Kingdom	4	59	0.25	50.0 – 400.0	146.85	9.3	3.0	158	0.10
United States	3	282	9.36	17.8 – 213.4	2502.86	472.8	41.5	1676	0.62
Vietnam	6	78	0.33	111.8 – 223.5	908.47	54.3	86.0	700	0.08

[a]Political Regime: 1=Republic; 2=Federal Parliamentary State; 3=Federal Republic; 4=Multiparty Liberal Democracy under Constitutional Monarchy; 5=Confederation with Parliamentary State; 6=Communist State; 7=Constitutional Monarchy; 8=Federal Republic under Centralized Government; 9=Military Regime; 10=Parliamentary Democracy; 11=Parliamentary Monarchy.

Source: World Bank (1997, 2000a), Glieck (1998), Saleth & Dinar (2004), and World Resources Institute (1999)

Data on water institutions for the sample countries include factual and judgmental variables. The judgmental variables represent perceptions of 127 water experts representing the sample countries. Saleth and Dinar selected the experts as representative of different regions, specializations, experience, and organizational affiliations. The factual variables were obtained from secondary sources from the World Bank (1997, 2000a). Below are descriptions of the variables for each institutional component:

Water Law:

a) Legal treatment of water and related resources (LTRWSA): Variable categorized with a value of 1 if all sources are treated alike or 0 for otherwise.
b) Format of water rights (LPSRSF): Variable includes categories of surface water rights ranging from 0-7 with 0 for no rights; 1 for unclear rights; 2 for common or state property; 3 for multiple rights; 4 for riparian rights; 5 for appropriative system; 6 for proportional sharing system; and 7 for license or permit system.
c) Provisions for conflict resolutions (LCRMEE): Variable is judged based on the perception of effectiveness of an institution's conflict resolution mechanisms ranging from 0 for least effective to 10 for most effective.
d) Provisions for accountability (LACPRE): Variable is judged based on the effectiveness of institution's laws to achieve accountability ranging from 0-10.
e) Scope of private sector participation (LOEPRV): Variable is judged based on an institution's legal ability to allow for private sector participation/management of water resources on a scale of 0-10.
f) Centralization tendency (LOECEN): Variable is judged based on the centralization tendency within water law on a scale of 0-10.
g) Degree of legal integration within water law (LINTRE): Variable is judged based on an institution's provision of laws that provide a legal framework for integrated treatment of water from different sources on a scale of 0-10.

Water Administration:

a) Organizational basis (AORGBA): Variable describes the spatial organization of water administration within the institution with 0 for no response; 1 for organization along administrative divisions; 2 for organization along both geographic and hydro-geological regions; 3 for broad hydro-geological regions; and 4 for organization along river basins.
b) Functional specialization (ABALFS): Variable is a balance of functional specialization within water administration with a value of 1 if balanced or 0 for otherwise.
c) Price controls (AIBDWP): Variable describes presence or absence of an independent body for water pricing with a value of 1 for presence or 0 for otherwise.
d) Budget constraints (ASBUDC): Variable is a judged based on the perceived seriousness of budget constraint facing administration ranging from 0-10.

e) Accountability of administration (AACCME): Variable is based on perceived effectiveness of administrative accountability mechanisms on a scale of 0-10.
f) Information quality (AARINF): Variable is based on perceived adequacy and relevance of information used in administrative decision making on a scale of 0-10.
g) Science and technological capabilities (AEXTST): Variable is based on perceived availability and use of science and technology in water administration on a scale of 0-10.

Water Policy:

a) Project-selection criteria (PPSCRI): Categorical variable of project selection criteria used by institution with 0 for no response; 1 for political dictates; 2 for equity factors; 3 for ecological factors; 4 for cost-benefit ratio; 5 for internal rate of return; 6 for multiple criteria.
b) Pricing and cost recovery (PCOREC): Categorical variable for cost recovery of water pricing policies with 0 for no response; 1 for full subsidy; 2 for partial recovery; and 3 for full-cost recovery.
c) Interregional and/or sectoral water transfer (PIRSWE): Variable is based on perceived effectiveness of water transfer policies on a scale of 0-10.
d) Private sector participation (PGPIPP): Variable is based on perceived effectiveness of policy impact on private participation in water sector on a scale of 0-10.
e) User participation (PGPIUP): Variable is based on perceived effectiveness of policy impact on user participation in water sector on a scale of 0-10.
f) Linkages with other policies (POPAWE): Variable is based on perception of amount of influence of other polices on water policy on a scale of 0-10.
g) Law-policy linkages (POELWL): Variable is based on perception of amount of linkage between water law and water policy on a scale of 0-10.

The sample size is small with 127 observations. There are no missing data. The descriptive statistics for the institutional variables are provided in Table 3.3.

Table 3.3 Descriptive Statistics of Institutional Components

Variables			Mean	Standard deviation	Range	
Names	Acronyms	Types			Min.	Max.
Water Law Variables						
Legal treatment of surface water rights	*LTRWSA*	Dummy	0.331	0.472	0	1
Format of surface water rights	*LPRSRF*	Categorical	2.606	1.470	0	7
Effectiveness of conflict resolution mechanisms	*LCRMEE*	Scale	5.235	2.565	0	10
Effectiveness of accountability mechanisms	*LACPRE*	Scale	4.426	2.683	0	10
Scope for privatization in water law	*LOEPRV*	Scale	4.662	2.601	0	10
Tendency for centralization in water law	*LOECEN*	Scale	5.063	2.878	0	10
Degree of integration within water law	*LINTRE*	Scale	3.622	3.326	0	10
Water Administration Variables						
Organizational basis	*AORGBA*	Categorical	2.504	1.463	0	5
Balance of functional specialization	*ABALFS*	Dummy	0.472	0.501	0	1
Independent water-pricing body existence	*AIBDWP*	Dummy	0.252	0.436	0	1
Seriousness of budget constraint	*ASBUDC*	Scale	3.381	3.289	0	10
Effectiveness of administrative accountability	*AACCME*	Scale	4.364	2.518	0	10
Adequacy of information	*AARINF*	Scale	6.217	2.190	0	10
Extent of science and technology applications	*AEXTST*	Scale	4.463	1.989	0	10
Water Policy Variables						
Project selection criteria	*PPSCRI*	Categorical	3.530	1.561	0	6
Level of cost recovery	*PCOREC*	Categorical	2.230	0.712	0	4
Effectiveness of water transfer policy	*PIRSWE*	Scale	3.277	2.384	0	8.75
Impact of private sector promotion policy	*PGPIPP*	Scale	4.284	3.105	0	10
Impact of user participation policy	*PGPIUP*	Scale	3.654	2.844	0	10
Impact of other policies on water policy	*POPAWE*	Scale	5.622	1.715	0	7
Overall linkage between law and policy	*POELWL*	Scale	5.660	2.429	0	10

As previously described the IFIA dimensions are based on policy knowledge and values. Knowledge represents institutional information and institutional ability to process that information. Policy values represent institutional beliefs regarding rights, trust, equality, equity, and efficiency. Table 3.4 lists the proposed relationship between institutional components and the implementation environment.

Table 3.4 Institutional Components by Implementation Factors

Implementation Factor: Knowledge of Policy Impact		
Variable	Description	Dimensional Attribute
LPSRF	Format of surface water rights	Information
LINTRE	Degree of integration within water law	Process
LOECEN	Tendency for centralization in water law	Process
LOEPRV	Scope for privatization in water law	Information
PPSCRI	Project selection criteria	Information
PCOREC	Level of cost recovery	Information
PGPIPP	Impact of private sector promotion policy	Information
POPAWE	Impact of other policies on water policy	Process
ABALFS	Balance of functional specialization	Process
ASBUDC	Seriousness of budget constraint	Information
AARINF	Adequacy of information	Process
AEXTST	Extent of science and technology applications	Process
Implementation Factor: Policy Values		
Variable	Description	Dimensional Attribute
LCRMEE	Effectiveness of conflict resolution	Rights
LACPRE	Effectiveness of accountability mechanisms	Trust
PIRSWE	Effectiveness of water transfer policy	Efficiency
PGPIUP	Impact of user participation policy	Equality
POELWL	Overall linkage between law and policy	Equity
AORGBA	Organizational basis	Equality
AIBDWP	Independent water-pricing body existence	Trust
AACCME	Effectiveness of administrative accountability	Trust

Results

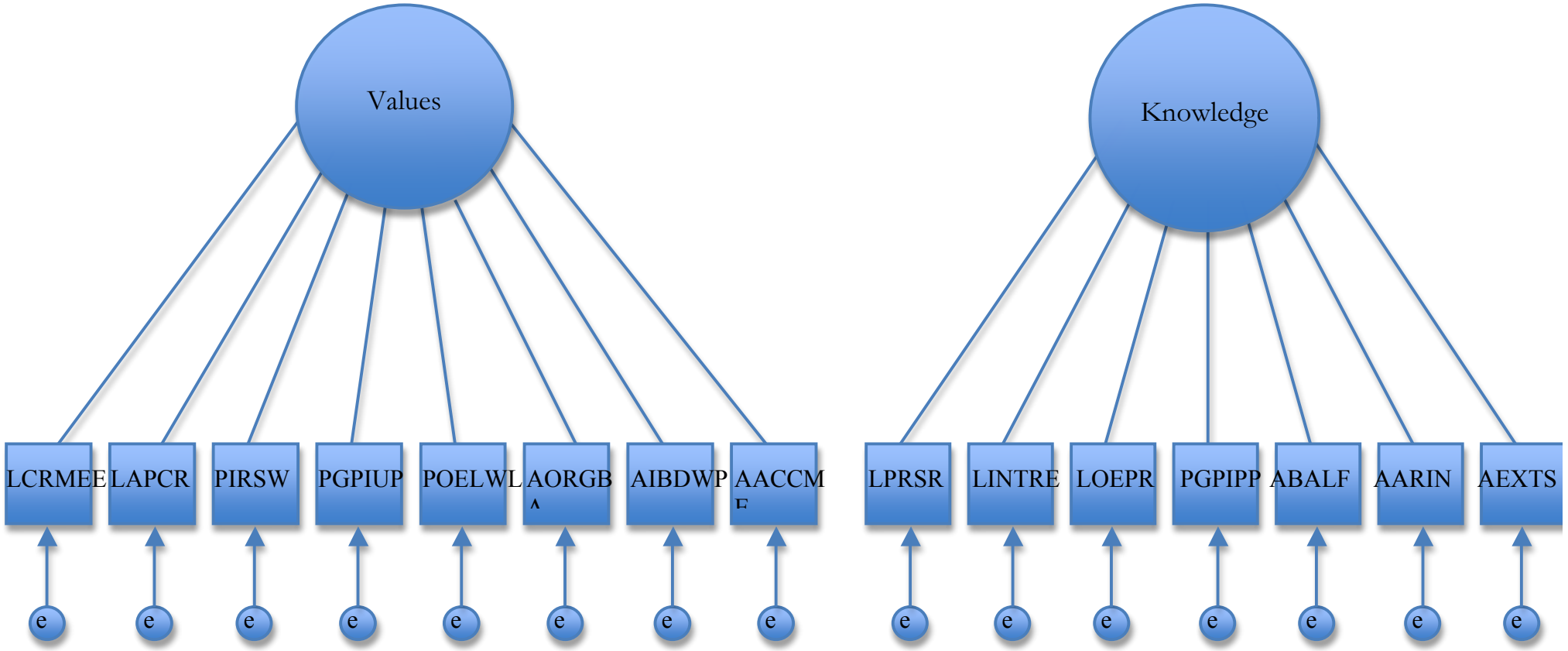
I used Stata Version 12.1 to perform the Confirmatory Factor Analysis using Maximum Likelihood estimation. A correlation table showing means and standard deviations is included in the appendix. I evaluated assumptions of multivariate normality using STATA 12.1 Doornik-Hansen. All 127 observations were used in the CFA with no missing data. The chi-square statistic for the model is 169 ($p = 0.0077$), suggesting poor model fit. Additional fit indices confirmed poor model fit. The comparative fit index (CFI) = 0.36, the Tucker-Lewis fit index (TLI) = 0.28, the RMSR =0.38, and the RMSEA = 0.05. Only the RMSEA meets the cut-off value (RMSEA < 0.06) for good fit.

Initial measurement models in CFA often fail to provide good fit (Andersen and Gerbring, 1988). In addition, measures of fit indices often over reject CFA models with small samples ($N \leq 250$) (Hu and Bentler, 1999). If the initial model is rejected, the model can be modified and tested again using the same data (Joreskog, 1993).

Given that the initial model was rejected, an alternative model was estimated. The alternative model specification used the following process. Variables whose correlations indicated association with both factors were eliminated to increase the unidimensionality of the proposed factors. The result of this process eliminated the following variables from the model: LOECEN, PPSCRI, ASBUDC, PCOREC, and POPAWE. These adjustments to the model resulted in two factors shown in Figure 3.3. The Maximum Likelihood estimates for the two-dimensional model are provided in Table 3.5. Given the small sample size, Satorra Bentler estimates are reported (Hu and Bentler, 1999).

Table 3.6 provides fit indices for the final model. Goodness of Fit indices for models with small sample size ($N < 250$) tends to over reject true population models (Hu and Bentler, 1999). The fit indices for the final model satisfy criteria for Chi-square with a p-

value of 0.21. Both the Comparative Fit Index of 0.93 and Taylor Lewis Fit Index score of 0.91 are above the cutoff value of 0.9. The root-mean squared error of approximation is 0.03 and below the cut-off value of 0.06. The root mean squared residual is 0.35 and above the cutoff value of 0.08.



Satorra-Bentler chi-square =89 (p= 0.3456); Goodness of Fit Index (GFI) = 0.93; Taylor Lewis Fit Index (TLI) = 0.91; Root Mean Square Error Approximation (RMSEA) = 0.03; Standardized Root Mean Square Residual (RMSR) = 0.35; e = error.

Figure 3.4 Final confirmatory factor analysis model for institutional implementation environments.

Table 3.5 Maximum Likelihood Estimates for a Two Dimensional Model

Coefficients	Satorra Bentler Estimates (Standard Errors)	Z-values (*p*)	R^2
Policy Values			
LCRMEE	1.0		0.28
LACPRE	1.35 (0.17)	7.49 (0.00)	0.46
PIRSWE	0.86 (0.19)	4.54 (0.00)	0.24
PGPIUP	0.76 (0.19)	4.07 (0.00)	0.13
POELWL	1.09 (0.20)	5.48 (0.00)	0.37
AORGBA	0.25 (0.11)	2.22 (0.03)	0.05
AIBDWP	0.08 (0.03)	2.53 (0.01)	0.06
AACCME	0.65 (0.19)	3.37 (0.00)	0.12
Knowledge of Policy Impacts			
LPSRF	1.0		0.03
LINTRE	5.32 (3.23)	1.65 (0.10)	0.19
LOEPRV	5.32 (2.92)	1.82 (0.07)	0.31
PGPIPP	3.03 (1.69)	1.79 (0.07)	0.07
ABALFS	0.78 (0.46)	1.71 (0.09)	0.18
AARINF	3.23 (2.08)	1.55 (0.12)	0.16
AEXTST	4.21 (2.49)	1.69 (0.09)	0.32

Table 3.5 Continued

Correlation of Dimensions	Satorra Bentler Estimates (Standard Errors)	Z-values (*p*)
Policy Values – Policy Knowledge	0.39 (0.22)	1.79 (0.07)
Variance of Errors		
LACPRE	3.87 (0.57)	6.83 (0.00)
PIRSWE	4.30 (0.44)	9.64 (0.00)
PGPIUP	6.97 (0.57)	12.19 (0.00)
POELWL	3.69 (0.67)	5.54 (0.00)
AORGBA	2.01 (0.22)	9.26 (0.00)
AIBDWP	0.18 (0.02)	9.57 (0.00)
AACCME	5.53 (0.61)	9.04 (0.00)
LPSRF	2.07 (0.22)	9.33 (0.00)
LINTRE	8.89 (0.82)	10.84 (0.00)
LOEPRV	4.63 (0.49)	9.39 (0.00)
PGPIPP	8.89 (0.78)	11.45 (0.00)
ABALFS	0.21 (0.02)	11.74 (0.00)
AARINF	3.99 (0.670	5.95 (0.00)
AEXTST	2.62 (0.33)	7.93 (0.00)

Table 3.6 Model Fit Indices for Confirmatory Factor Analysis

Model[a]	Chi-square	df	*p*-value	Comparative Fit Index (CFI)	Taylor-Lewis Index (TLI)	RMSEA	RMSR
M_i	217	169	0.01	0.35	0.28	0.05	0.38
M_2	99	89	0.21	0.93	0.91	0.03	0.35

[a]M_i = Initial model specification
M_2= Final model specification. Santorra Bentler chi-square = 93 df(89) and p=0.37

The institutional variables for the dimension of policy values are all statistically significant at a p-value of 0.05. The effectiveness of the accountability mechanisms had the largest coefficient for the policy value. Stakeholders within water institutions expect the rules to be followed by participants. The presence of an independent water pricing body had the lowest coefficient contribution to policy value. This finding suggests that pricing of water is important. However, the presence of an independent water pricing body is not essential provided that other mechanisms exist for trust and equity

The institutional variables for the dimension of policy knowledge were statistically significant at a p-value of 0.10. The variable describing degree of integration with water law and the variable for scope of privatization have the largest coefficient size for the knowledge variable. Integration within water law supports the assertion that agreement on knowledge of policy impacts is critical to institutional design. Greater levels of integration of multiple laws allow institutional actors to have a more holistic knowledge of the ramifications of policy action. This knowledge allows actors to anticipate impacts and reduce levels of uncertainty during the implementation process. The scope for privatization also is a variable that increases knowledge of impact of policy action. Allowance of private sector participation in the institutional environment expands the number of institutional actors and knowledge

base. The variable of balance of functional specialization had the smallest coefficient size. Balance of functional specialization within water institutions is important to understand the impacts of different policy actions. Institutional actors, representing public and private organizations, may provide the balance of functional specialization.

Conclusion

The implementation model tested in this chapter offers insight into the policy implementation environment influencing water institutions. The dimensions of policy values and knowledge of policy impacts has support from analysis of water institutional data. The dimension of policy values has stronger support in the model than knowledge of policy impacts. The model is distinct from other frameworks for institutional analysis in that the implementation environment is considered a key influence of institutional design and performance.

The results of this examination are an important contribution to the study of water institutions. The influence of policy values and policy impact knowledge supports arguments that a "hydrocentric" point of view will reduce the effectiveness of water institutions. The Implementation Framework for Institutional Analysis asserts that the design of water institutions needs to consider the degree of agreement on policy values and policy impact knowledge. These two dimensions create different implementation environments that require different governance structures to meet policy goals.

Confirmation of the policy values and knowledge of policy impacts are important contributions to institutional analysis. The implementation framework provides three key insights for institutional analysis. First, the policy implementation environment is a critical influence on the governance structure. Second, policy implementation's influence on

institutions asserts that agreement on knowledge and values are the primary dimensions at work. Lastly, the framework provides a mechanism to study the evolution of institutions as agreement on knowledge and values change.

In conclusion, I hope that the proposed framework can be used to better understand the relationship between institutional performance and policy implementation. While the model is straightforward, placing institutional design within the context of implementation environments provides new insights. The next chapter will further explore this topic by examining performance of institutions with respect to implementation environments. More specifically, I will examine the performance of water institutions ability to address water scarcity.

CHAPTER 4

Implementation Environments and Water Scarcity

Introduction

This chapter further expands the inquiry into the applicability of the Implementation Framework for Institutional Analysis (IFIA) to persistent policy issues. An empirical examination is presented on the effect of policy implementation environments on institutional performance. This relationship is examined through analysis of water policy outcomes related to water scarcity. This study uses a novel approach to the study of water scarcity that derives institutional typologies based on the IFIA. This framework is used to show that water scarcity is as much a function of implementation environments as it is a problem of physical water supply.

For example, lack of access to adequate sanitation is a critical problem in most developing countries (Barry & Hughes, 2008). This water policy problem is not solely due to lack of physical resources or large capital investment for infrastructure, but also likely a result of the mismatch between institutions and the implementation environment.

> At the national level, sanitation is afforded a low investment priority by governments. In Madagascar, for example, where only 4% of the population have access to a hygienic latrine, sanitation represents only 0.3% of the total allocation for water and sanitation, which itself is only 3% of the national budget [28]. And national investments in sanitation are predominantly financed by aid rather than national revenue.(Cumming, 2009)

Clearly the situation in Madagascar is an example of an implementation environment where policy values and policy knowledge are misaligned. I argue that these types of

implementation environments create institutions that require strong political action or coalition strength to improve institutional performance. If these institutional typologies with improved institutional performance are better suited to address water scarcity problems, such as lack of access to sanitation, water scholars will benefit from insights into the relationship between institutions and implementation environments. As Wildavsky stated, "policy implementation matters"(Pressman and Wildavsky, 1973).

The use of policy implementation frameworks for institutional analysis is critical for understanding institutional performance. The implementation framework recognizes the diversity of institutions at work that often deal with poorly defined policy problems and policy actions. For example, the definition of "water scarcity" seems clear, but when it is phrased as a question—"Water scarcity for whom?"—the definition becomes subjective.

Current literature provides several definitions of water scarcity: lack of water for certain geographic regions, lack of water for certain users, and lack of water due to climatic concerns (Rijsberman, 2006). The most appropriate category of water scarcity depends on the policy question. For instance, does sufficient water exist for food security, public health, or support of environmental systems? The viewpoint that water scarcity is contextual infers that the makeup of the water institutions plays a significant role in addressing the policy problem (Conca, 2006). Changes in water institutions to address scarcity concerns related to irrigation supply for agriculture may not achieve the same policy goals as changes to address health concerns of universal access to clean water.

The temporal nature of policy processes also contributes to mismatches between institutional adaptation and policy outcomes (Baumgartner & Jones, 1993; Kingdon, 2003; Wilhite, 2005). Institutional changes during periods of crisis, such as severe drought, may not be fully implemented if the crisis quickly disappears (Wilhite, 1997). In short, an

implementation framework provides traction to understand institutional performance given the opaqueness of policy problems and dynamic nature of the policy process.

This chapter proceeds as follows. The next section provides an overview of the literature on water scarcity and policy outcomes. That section is followed by the proposed hypotheses, methodology, and results. Lastly, the chapter concludes with analysis of the results and implications for future research.

Water Scarcity

This section will discuss three subjects: measures of water scarcity, their relationship to policy outcomes, and use of typologies to discern different effects on policies. Water scarcity has several interpretations within the literature. Rijsberman examines technical measures for water scarcity (Rijsberman, 2006). These measures show that scarcity can vary from situational or disaster-related scarcity to physical scarcity as a function of supply and demand. A country may experience water scarcity due to severe drought or other factors that cause insufficient water supply. Rijsberman suggests that all water scarcity measures are contextual and depend on how users (human and environmental) of water needs are defined, how much of the resource is available for each need, and the temporal and spatial availability of the resource (Rijsberman, 2006). Lack of water supply to meet user demand is the most common interpretation of the term "water scarcity".

Scarcity can also be related to inefficient use of water. Geographic areas may have sufficient water resources to meet basic human health needs, but they may lack supply to meet other demands for water, such as ethanol production or landscaping in arid regions (Glennon, 2009).

A less discussed but equal interpretation of water scarcity is lack of access to adequate sanitation facilities, which results in water pollution, contamination of supply sources, and significant impacts on human health (Barry & Hughes, 2008; Cumming, 2009). Access to adequate sanitation facilities is necessary to provide adequate water supply and protect human health. The lack of access to adequate sanitation is a direct result of institutional failures.

The many interpretations of water scarcity complicate the process of institutional design. Changes to institutions to solve one interpretation of water scarcity may be insufficient to address other types of water scarcity. The issue of developing a consensus interpretation for water scarcity is beyond the scope of this investigation. However, use of different interpretations of scarcity allows a nuanced evaluation of the relationship between institutional typologies and water scarcity.

This study uses two different measures of water scarcity: access to clean water and access to sanitation facilities. Both of these variables measure a different aspect of policy problems associated with water scarcity. Ultimately, the lack of access to clean water or sanitation in a given location results from action or inaction within a water institution.

In short, it is my belief that the ability of institutions to address their respective policy problems is related to variations in policy implementation environments based on dimensions of agreement on policy values and knowledge of policy impacts. I think that one would be hard pressed to find any institution or institutional actor against universal access to clean water or adequate sanitation facilities. Yet one will find great variation among institutions and their actors in the level of agreement on the policy values and knowledge to achieve these policy goals. The most prominent impetus of disagreement is bound in the trade off of policy values such as economic efficiency and equality. Also, disagreements

between institutional actors arise over competing knowledge of the impact of the proposed policy action (Stone, 2005). Institutional actors use competing information to support their positions and actions. Within these implementation environments, one water institution may be better suited to address issues of access to clean water but not adapted to issues of sanitation. Previous research on political, social, and economic attributes affecting access to water and sanitation suggest that economic development is a key factor (Whitford, Smith, & Mandawat, 2010).

This finding is interesting given that economic development is the result of many attributes, including private sector productivity, availability of capital and resources, and institutions. The level of economic development within a country represents the country's institutional capacity to navigate conflicts between policy values and policy knowledge. Water institutions represent only one component of a larger institutional environment associated with economic development. However, the success of society's development has in large part been related to its ability to harness and exploit its water resources (Solomon, 2010). The a priori nature of water institutions in relation to economic development suggest that greater access to water and sanitation is a reflection of better institutional performance.

As I have argued for the importance of implementation environments, I propose that institutions with high rates of success in addressing water scarcity are operating in implementation environments that mitigate conflicts between policy values and disagreement over knowledge of policy impacts. Figure 4.1 shows a scalar model adaptation of the Implementation Framework for Institutional Analysis. The adaptation is necessary to demonstrate the relationship of implementation environments on institutional performance. The model includes two scales: level of agreement on knowledge of policy action impacts (knowledge) for the x-dimension and level of agreement on policy values (values) for the y-

dimension. As agreement on knowledge increases, I expect to find institutional environments that create networked and administrative institutions. Agreement on policy values increases from levels of concentrated agreement among a few institutional actors to consensus agreement among a broad range of institutional actors. At the lower scale the agreement on policy values may have a high degree of conflict or be uncontested. I expect institutional performance to increase as agreement on policy knowledge and policy values increase.

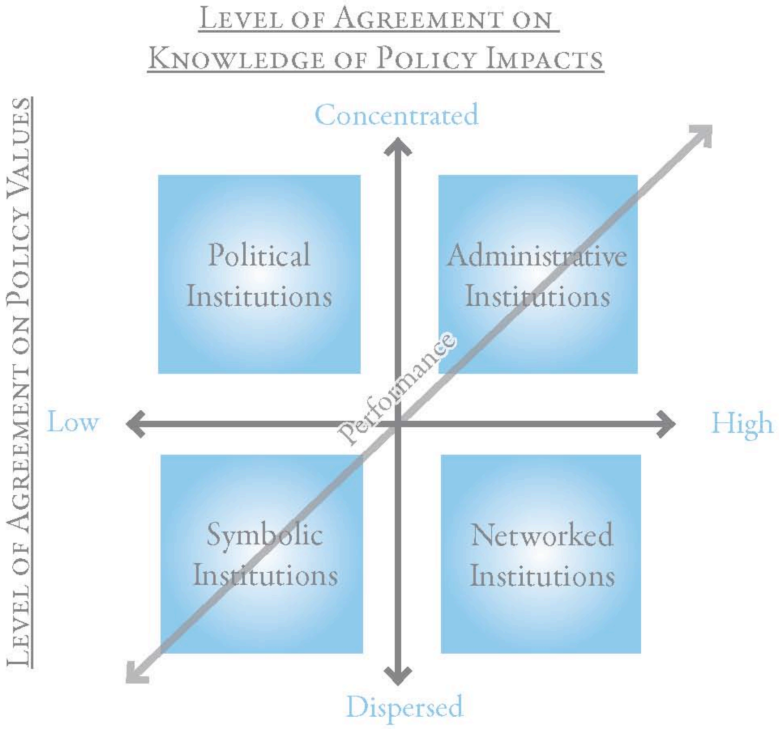


Figure 4.1 Adapted model of implementation framework for institutional analysis.

Hypotheses and Methodology

The scalar model provides a point of reference to assess institutional performance and institutional typologies for a given implementation environment. Given the relationship, I expect the following hypotheses:

> H1: Institutional performance increases as level of agreement on policy values increases. I expect that an institution's measure of agreement on policy values will increase as the population's level of access to clean water and sanitation increases.

> H2: Institutional performance increases as level of agreement on knowledge of policy impacts increases. I expect that an institution's measures of agreement on policy knowledge will have a positive relationship with the population's level of access to clean water and sanitation.

These hypotheses suggest that Administrative and Networked institutions will have higher levels of access to clean water and adequate sanitation. Providing access to water has shifted from the state-centric model of the pre-1950s period. The state-centric model is aligned with governance style of an Administrative Institution. Within this institution, policy values reflected agreement among a concentrated group of stakeholders. The policy value of economic efficiency was uncontested allowing many countries to readily create water supply sources and provide universal access. After the decline of the state-centric model, institutions responsible for access to water faced opposition to supply-oriented policy values. The ability to create new reservoirs or change surface water flow conditions is very limited. The rise of globalism and environmentalism created a different implementation environment

from the previous hydrocentric environment. Today's water institutions look to the use of Integrated Water Resource Management and other techniques to build consensus on policy values related to access to clean water. This consensus implementation environment aligns with Networked Institutions that are able to develop nuanced approaches appealing to diverse institutional actors in order to generate agreement on a desired policy outcome.

The access to adequate sanitation or management of wastewater has been a secondary priority to improvements in clean water supply, despite the environmental linkages. Even major cities in the United States lacked widespread provision of wastewater collection systems to their populations up until the 1950s. From the classic economic perspective, many view access to water as a commodity equivalent to a toll good. The access to clean water is easily excludable, given the infrastructure systems that must be built to treat and supply the water. Even deep water wells can represent a significant expense for developing communities. Clean water is a consumable resource that can be considered fully subtractable under scarcity conditions. However, wastewater lacks the same categorization as a toll good or private good under classic economic theory. The need for adequate sanitation is a consequence or externality of human existence/production, especially in dense urban environments. Access to sanitation is treated as a common pool resource. It is a common pool resource because adequate sanitation facilities protect human health and the environment. This type of good is difficult to provide under normal market assumptions. First is the free-rider problem, the provision of adequate sanitation facilities, which without strong regulations does not force all to use and thus pay for these facilities. Secondly, lack of adequate regulations can cause overconsumption of the assimilative capacity of the environment to receive and treat the wastewater. Given the need for strong regulation, provision of adequate sanitation occurs in implementation environments with concentrated

policy value agreement. These environments are reflective of Administrative Institutions, which operate in an environment of strong agreement on policy solutions and a concentrated interest group support for the policy action.

Methods

Two ordinary least squares regression models are used to assess effects of implementation environments on institutional performance. Institutional performance is measured as level of water scarcity within a country. This level is measured through two separate dependent variables of water scarcity: percent of population with access to clean water and percent of population with access to adequate sanitation facilities. The proposed model is as follows:

Institutional Performance = f[Implementation Environment Factors] + Environmental Factors

The measures of implementation environment represent a two-dimensional scale. The first dimension represents the level of agreement on policy values. The second dimension represents the level of agreement on the knowledge of impacts of proposed policy action. The interaction of these two dimensions is reflective of four possible institutional structures: Administrative, Networked, Political, and Symbolic. The environmental factors in the model represent the controls including amount of environmental resources and socio-economic conditions. The basic model is further specified into the following two equations.

Equation 1:

$$WaterAccess = \beta_0 + \beta_1(PolicyKnowledge) + \beta_2(PolicyValues) + \beta_{n+1}(Environment) + \varepsilon$$

Equation 2:

$$SanitationAccess = \beta_0 + \beta_1(PolicyKnowledge) + \beta_2(PolicyValues) + \beta_{n+1}(Environment) + \varepsilon$$

Data

The data used for this investigation comes from two sources: The World Health Organization's Joint Monitoring Program (JMP) for Water Supply and Sanitation and the World Bank Study of Water Institutions (WBWI) conducted by Saleth and Dinar. The JMP produces country-level data on access to drinking water sanitation every two years. The JMP's primary purpose is to provide measurement on the United Nations' Millennium Develop Goal to reduce by half the percent of population without access to clean water or adequate sanitation. The WBWI reflects a specific study of country-level water institutions. The study collected survey data on these institutions in order to understand relationships between internal institutional structures and performance. The performance measurements for the WBWI reflect perceptional performance of water institutions based on responses from survey participants as opposed to performance based on measure of policy outcomes proposed in this chapter.

The dependent variables used in this study include two measures of policy outcomes related to water institutions: access to safe drinking water and access to basic sanitation. Data are measures of the proportion of society within a given country that have access to improved drinking water and/or sanitation facilities. The dependent variable data are derived by the WHO Joint Monitoring Programme from a compilation of information collected by national statistics offices and recognized international survey programs.

Access to safe drinking water: This variable measures proportion of population in each country that uses improved drinking water sources, such as municipal supply or protected wells. The data can also be further categorized into three areas of unimproved drinking water source, other improved source, and improved source

(i.e., piped into the dwelling unit). Data on water and sanitation access are used for the year 2000 in order to align with the time period of survey data collected on water institutions. While the JMP dataset includes scarcity measures for 211 countries, the dataset was parsed to match the 39 countries included in the World Bank Institutions dataset.

Access to basic sanitation: This variable measures proportion of population with access to improved sanitation facilities, such as pit latrines with slab, flush toilets, and other sanitation technologies. Similar to access to safe drinking water, the sanitation data can be refined into four categories: open defecation, unimproved sanitation facilities, shared facilities, and improved facilities.

The independent variables for the model are based on the factor analysis of the World Bank Institutional Data used in the confirmation of the Implementation Framework for Institutional Analysis. The factor analysis yielded two independent variables: level of agreement on policy values (Policy Values) and level of agreement on knowledge of impacts of proposed policy (Policy Knowledge). The data for these two independent variables, hereinafter referred to as Values and Knowledge, were estimated from the confirmatory factor analysis used in the previous chapter. The natural log transformation of the variables was used to reflect the level of agreement on policy values and policy knowledge. Data on the Untied States was omitted due to lack of consistency with other control data.

The control variables for the analysis include the following: GNP/Capita, Population Density, Land Area, Arable Land per Capita, Freshwater Withdrawal/Year/Capita, Agricultural Share in Total Water Withdrawal, Gini Index, Environmental Regulatory

Regime Index, Institutional Investor Credit Rating, Political System, Public Expenditure on Education, and Food Production Index. The data reflect values for the year 2000 for the 39 countries included in the dataset. Table 4.1 provides the water and sanitation profiles of the sample countries. Table 4.2 provides descriptive statistics for the model. Figures 4.2–4.4 provide perspective on access to water, access to sanitation, and water withdrawal per capita.

Figure 4.2 Percent of population with improved access to clean water for the year 2000.

Figure 4.3 Percent of population with access to adequate sanitation for the year 2000.

Figure 4.4 Year 2000 annual freshwater withdrawal per capita.

Table 4.1 Water and Sanitation Profiles of Sample Countries

Country Name	Political Regime[a]	Population (million)	Area (million km^2)	Annual Rainfall (cm)	Renewable water resources (bcum)	Annual freshwater withdrawals, total (bcum)	Percentage used for agriculture	Freshwater Withdrawal per capita (m^3)	Arable land (hectares per person)
	(1997)	(2000)	(2000)	(2000)	(Various years)	(2000)	(2000)	(2000)	(2000)
Argentina	1	37	2.78	5.0–500.0	1031.01	32.6	66.1	882	0.76
Australia	2	19	7.74	12.7–127.0	356.76	23.9	75.3	1248	2.47
Bangladesh	1	129	0.14	101.6–203.2	1233.41	14.6	86.0	113	0.07
Bolivia	1	8	1.10	25.4–177.8	309.00	2.0	57.2	244	0.36
Brazil	3	174	8.55	60.0–360.0	7133.11	59.3	61.8	340	0.33
Cambodia	4	12	0.18	38.1–76.2	496.88	4.1	98.0	328	0.30
Canada	5	31	9.97	38.1–203.2	2856.40	46.0	11.8	1494	1.49
Chile	1	15	0.76	5.0–20.0	480.11	11.3	70.3	735	0.11
China	6	1262	9.60	12.7–76.2	2856.25	525.5	77.0	416	0.10
Egypt	1	68	1.00	5.0–20.0	58.84	68.2	86.4	1008	0.04
France	1	61	0.55	63.0–140.0	191.51	31.8	12.3	523	0.30
Germany	3	82	0.36	50.0–250.0	177.86	46.3	16.0	563	0.14
India	3	1054	3.29	13.0–1100.0	1943.11	610.4	91.5	579	0.15
Indonesia	1	213	1.91	100.0–500.0	2613.38	113.3	81.9	531	0.10
Israel	1	6	0.02	2.5–35.5	1.10	1.7	64.0	270	0.05
Italy	1	57	0.30	76.2–127.0	168.72	45.3	44.1	796	0.15
Japan	7	127	0.38	76.2–203.2	432.05	88.4	62.5	697	0.04
Korea, Rep.	1	47	0.10	130.0	70.55	23.7	63.0	504	0.04
Lao PDR	6	5	0.24	110.0–370.0	283.19	3.0	90.0	564	0.17
Mexico	8	99	1.96	15.0–170.0	463.56	77.8	78.0	778	0.25
Morocco	7	29	0.45	12.7–76.2	30.04	12.6	87.4	437	0.31

Country Name	Political Regime[a]	Population (million)	Area (million km^2)	Annual Rainfall (cm)	Renewable water resources (bcum)	Annual freshwater withdrawals, total (bcum)	Percentage used for agriculture	Freshwater Withdrawal per capita (m^3)	Arable land (hectares per person)
	(1997)	(2000)	(2000)	(2000)	(Various years)	(2000)	(2000)	(2000)	(2000)
Myanmar	9	45	0.68	76.2–127.0	1058.18	33.2	89.0	739	0.22
Namibia	1	2	0.82	5.0–70.0	54.75	0.3	71.0	158	0.43
Nepal	10	24	0.15	100.0–400.0	211.58	10.1	97.6	412	0.10
Netherlands	3	16	0.04	62.5–92.5	92.75	7.8	34.0	490	0.06
New Zealand	10	4	0.27	60.0–150.0	344.21	2.1	42.2	547	0.39
Pakistan	1	145	0.80	30.5–162.5	261.63	172.6	94.3	1194	0.15
Philippines	1	77	0.30	236.0	338.26	55.4	88.0	717	0.07
Poland	10	39	0.32	60.0–100.0	63.53	13.1	10.3	341	0.36
Portugal	1	10	0.09	50.0–100.0	72.73	11.9	74.2	1162	0.16
South Africa	1	44	1.22	5.1–134.6	50.74	12.5	62.7	284	0.33
Spain	11	40	0.51	15.2–139.7	111.03	37.1	65.1	922	0.33
Sri Lanka	1	19	0.07	30.4–233.7	44.25	13.0	92.2	694	0.05
Sudan	9	34	2.38	70.0–100.0	31.15	37.1	97.1	1086	0.48
Thailand	4	63	0.51	127.0–230.0	415.28	33.1	91.0	524	0.25
Tunisia	1	10	0.16	10.0–25.0	3.95	2.8	86.0	293	0.30
United Kingdom	4	59	0.25	50.0–400.0	146.85	9.3	3.0	158	0.10
United States	3	282	9.36	17.8–213.4	2502.86	472.8	41.5	1676	0.62
Vietnam	6	78	0.33	111.8–223.5	908.47	54.3	86.0	700	0.08

[a]Political Regime: 1=Republic; 2=Federal Parliamentary State; 3=Federal Republic; 4=Multiparty Liberal Democracy under Constitutional Monarchy; 5=Confederation with Parliamentary State; 6=Communist State; 7=Constitutional Monarchy; 8=Federal Republic under Centralized Government; 9=Military Regime; 10=Parliamentary Democracy; 11=Parliamentary Monarchy.

Source: World Bank (1997, 2000a), Glieck (1998), Saleth & Dinar (2004), and World Resources Institute (1999)

Table 4.2 Descriptive Statistics of Model Variables

Variables			Mean	Standard deviation	Range	
Names	Acronyms	No. Obs.			Min.	Max.
Dependent Variables						
Percent of population with access to improved source of water	*WNIPOPPER*	117	88.84	11.11	44	100
Percent of population with access to improved sanitation	*SNIPOPPER*	116	71.44	27.30	17	100
Independent Variables						
Level of agreement on knowledge of policy impacts	*KNOWPI*	127	8.62 e – 11	0.34	–1.00	0.83
Level of agreement on policy values	*AGREPA*	127	4.00 e – 09	1.60	–4.05	4.04
Control Variables						
GNP per capita	*GNPPPC*	120	10,772.42	10,104.14	530	35,690
Population density (persons/sq.km)	*POPDEN*	120	166.17	199.69	2.30	995.56
Arable land per capita (hectares/person)	*ALANDC*	120	0.36	0.56	0.04	2.47
Annual Freshwater Withdrawal (billion m^3)	*ANNFWWD*	120	105.14	181.69	0.30	610.4
Agricultural share in total water withdrawal (% of Total Withdrawals)	*PWATAG*	120	69.20	24.10	3.00	98.04
GINI Index	*GINIIND*	120	40.33	9.73	28.31	63.90
Env. Regulatory Regime Index	*ENVRRI*	120	-0.07	0.77	-1.01	1.75
Institutional Investor Credit Rating	*ININCR*	120	55.17	21.0	16.9	92.9
Political system	*POLREG*	120	3.95	3.27	1	11
Public expenditure on education (% of GDP)	*EXPEDU*	120	4.24	11.11	44	100
Food Production Index	*FPIIND*	120	89.36	9.47	68	100

Source: World Bank (1997, 2000a), Glieck (1998), Saleth & Dinar (2004), and World Resources Institute (1999)

Results

An ordinary least squares regression model was used to develop parameter estimates. A l natural log transformation of the implementation factors was used for the independent variables in order to account for the lack of true index for the variables. Therefore the sign of relationship, scale of estimate, and statistical significance of variables are the primary attributes of the model. The regression results are listed in Table 4.3.

Table 4.3 Summary of Model Estimate (Robust Errors Reported)

	Model 1: Percent of Population with Access to Clean Water (2000)	*Model 2: Percent of Population with Access to Adequate Sanitation (2000)*
Variable		
Implementation Factors		
Level of Agreement on Knowledge of Policy Impacts	-8.64 (4.38)*	-6.82 (0.35)
Level of Agreement on Policy Values	4.17 (1.93)*	6.48 (0.04)*
Control Variables		
Public Expenditure on Education (% of GDP)	2.49 (0.85)**	2.82 (0.01)*
Food Production Index Score	-0.11 (0.09)	-0.26 (0.06)*
Population Density (persons/sq. kilometer)	0.013 (0.01)*	0.01 (0.01)*
Agricultural Water Withdrawal (% of Total Freshwater Withdrawals)	0.11 (0.04)**	0.11 (0.13)
Annual Freshwater Withdrawals (billion cubic meters)	0.01 (0.01)**	-0.04 (0.00)**
Freshwater Withdrawal per Capita (cubic meters)	0.01 (0.00)**	0.01 (0.03)*
Arable Land per Capita (hectares/person)	-2.99 (1.28)*	0.05 (0.98)
GNP/Capita ($)	0.001 (0.00)**	0.001 (0.00)**

Table 4.3 Continued

	Model 1: Percent of Population with Access to Clean Water (2000)	*Model 2: Percent of Population with Access to Adequate Sanitation (2000)*
Variable		
Decadal Population Change 1990 -2000 (%)	-27.72 (10.16)**	-107.16 (0.00)**
GINI Index (Year 2000)	0.43 (0.00)**	0.49 (0.00)**
Environmental Regime Index Score	7.38 (2.78)**	-2.72 (0.63)
International Investor's Credit Index	-.28 (0.09)**	0.09 (0.51)
Share of Natural Capital in Total Wealth (%)	-0.44 (0.20)*	-1.03 (0.00)**
Political Regime	-.29 (0.20)	-1.43 (0.00)**
Constant	67.78 (7.61)**	56.38 (0.00)**
R^2	0.82	0.65

* Significant at 5%, ** Significant at 1%

The model results provide interesting findings. The level of agreement on policy values is statistically significant at $\rho > 0.05$ and positively associated with percent of population with access to clean water. This finding supports the hypothesis that positive institutional performance is associated with higher levels of agreement on policy values. These implementation environments correspond to Networked Institutions that create broad level-of-consensus agreements on policy values between institutional actors and Administrative Institutions where level of agreement is concentrated among a narrow range of institutional actors.

The level of agreement on knowledge of policy impact is statistically significant at $\rho > 0.05$ and negatively associated with percent of population with access to clean water. This

finding is contrary to the proposed hypothesis that increased agreement on policy knowledge would be positively associated with institutional performance. While the model does not support the second hypothesis related to policy knowledge, a logical argument is offered in support of the hypothesis. The model and data are limited to an observation of a single year. This indicates that the measurement of agreement on knowledge of policy impacts may not be reflective of the current level of access to clean water; it may be more reflective of a limitation of existing data and modeling methodologies. For example, the Untied States did not achieve universal access to clean water in major metropolitan areas until the 1950s (Forrester, 1969). During this time period, water institutions operated in a hydro-centric environment with little debate over policy prescriptions for water supply. This era of large-scale water supply projects resulted in a significant increase in water reservoirs and water treatment plants throughout the United States and the world. However, the current environment for water institutions does not reflect the same level of agreement on policy prescriptions for improving access to clean water. Thus the model is likely more reflective of the current state of disagreement among institutional actors, including those institutions with large percentages of population with access to clean water.

The model yields similar results when examining the percent of population with access to adequate sanitation facilities. The level of policy values agreement is statistically significant at $\rho > 0.05$ and positively associated with percent of population with adequate sanitation facilities. This finding suggests that agreement on policy values leads to increased levels of institutional performance.

Similar to the finding on access to clean water, agreement on knowledge of policy impacts is negatively associated with increased percent of population with adequate sanitation facilities. However, policy knowledge is not statistically significant in this model.

Once again, the negative association between agreement on policy knowledge and policy outcome is a reflection of the disagreement within the implementation environment at time of data collection. The lack of statistical significance discounts empirical discussion of the relationship between the measure and institutional performance, but it does not weaken the importance of agreement on policy knowledge on performance. Given the basis of the implementation factors variables, the measures of agreement on policy knowledge may be more reflective of institutions whose primary purpose is access to drinking water, not access to sanitation.

Conclusion

This chapter has examined the relationship between implementation factors and institutional performance related to measures of water scarcity. I have found support for the influence of agreement on policy knowledge and agreement on knowledge of policy impacts on institutional performance. Water institutions that have built broad consensus on policy values are more likely to have higher levels of access to clean water and sanitation. The results for agreement on policy knowledge suggest that the level of agreement influences policy outcomes, but not as proposed in the hypothesis. A weakness of the model is lack of ability to account for changes in institutional environments over time with respect to policy outcomes. The next chapter seeks to address this shortcoming with a narrow focus on Administrative Institutions and institutional performance.

The larger implication of the findings supports the Implementation Framework for Institutional Analysis (IFIA) as a viable tool for examining institutional performance. The dimensions of policy knowledge and policy values complement more detailed institutional analysis frameworks, such as Ostrom's IAD Framework and Saleth and Dinar's IDA

framework. The IFIA provides an avenue to examine institutional performance based on implementation factors. Although it is not possible to make definitive conclusions about the scale of the implementation factors, it is clear that agreement on policy values and policy knowledge contribute significantly to institutional performance.

CHAPTER 5

Implementation Environments and Drought Management Plans

Introduction

This chapter further explores the application of the Implementation Framework for Institutional Analysis (IFIA) through a focused review of Administrative Institutions and water scarcity. Within the IFIA, Administrative Institutions are associated with policy implementation environments that have concentrated agreement on policy values and high levels of agreement on knowledge of policy impacts. These implementation environments represent an ideal condition for achieving institutional goals. The level of agreement on policy values and policy knowledge align institutional actors into an implementation environment with specific action on clear policy goals. As described in previous chapters, water scarcity, described as access to clean water or sanitation, is often not representative of a policy problem for Administrative Institutions. However, drought management, another variation of water scarcity, provides a more suitable application for Administrative Institutions.

Growing global concerns about water scarcity are often punctuated by occurrences of drought. The causes of drought, largely a function of climate, are not under direct control of water institutions. The impacts of drought on society can be large and widespread, as exemplified in a recent article on Afghanistan:

> Afghanistan could face a serious drought in 2011 that would make millions of poor go hungry and fuel instability as foreign troops seek to reverse surging violence in the battle against the Taliban.
>
> Low rainfall early in the wet season will likely threaten Afghanistan's irrigated harvest, forecasts show, which with a surge in global grain prices could be devastating for a nation already ranked as having the world's worst food security. Officials are concerned drought, which could be averted if rain and snow fall heavily in coming weeks, could further destabilize Afghanistan as Washington races to prove it can turn back a tenacious Taliban before an initial withdrawal in July. (Missy, 2011)

The impacts of drought in Afghanistan may differ from impacts in other countries, but solutions to mitigate the impacts are similar worldwide (Wilhite, 2000a). The mitigation solutions include a variety of measures from policy changes to changing the culture of current water management strategies (Wilhite & Diodato, 2006). A core component of these recommended solutions is creation of drought management plans or policies at national, regional, and local institutions. These plans are developed and administered by water institutions to govern water allocation during times of climatic water scarcity.

In this chapter, I provide empirical support for the relationship of implementation environments to institutional typologies through examination of drought management plan adoption within state-level water institutions. The theoretical underpinning of the IFIA framework described in chapter two is tested on comparative water institution data representing forty-eight states within the United States. Using the IFIA, I confirm the presence of Administrative Institutions under implementation environments with concentrated levels of agreement on policy values and high levels of agreement on knowledge of policy impact as two variables influencing institutional design.

This chapter proceeds as follows. The next section provides background on the literature on drought management plans. That section is followed by the proposed hypotheses, methodology, and results. Lastly, the chapter concludes with analysis of the results and implications for future research.

Drought Management

Although the ability to assess drought conditions began in the 1960s, it has only been since the 1980s that formal, state-level drought management planning has been implemented (Wilhite, 1997). Drought has a huge economic and societal impact on communities. The Climate Prediction Center estimated that severe droughts across the United States during 1988 created economic damages of over $39 billion dollars (1988 dollars) (Wilhite & Diodato, 2006). A 2006 report sponsored by the Geological Society of America and twenty other organizations identified ten recommendation to change the paradigm of drought management and improve institutional capacity to mitigate drought (Wilhite & Diodato, 2006). Drought management plans for water institutions are a core component of those recommendations.

Drought management plans are formal guidance documents that provide clear directions on government roles and responsibilities, triggers and timelines for action, and procedures for government response based on drought levels. They have two main purposes (Wilhite, 2000b). First, they are meant to reduce drought-related impacts on communities through defined mitigation plans. Second, they are designed to improve interagency coordination between levels of government. The first U.S. states to adopt drought management plans were South Dakota (1981), Colorado (1981), and New York (1982) (Wilhite & Rhodes, 1994). The most recent state to adopt a drought management policy is Alabama (2004), bringing the current total to forty states with official drought management policies.

The nomenclature "drought management plan" is a relatively recent phenomena attributed to the study of droughts and drought management beginning in the late 1980s (Wilhite, 1997). The practice of allocating water during scarcity is evident in the early

hydrological societies described in Chapter 1 (Wittfogel, 1957). Early water institutions allocated water in reaction to declining water supply. Modern water institutions have the benefit of climatic indicators to assess drought conditions and forecast impacts on water supply. The ability to measure drought and water supply make the creation of proactive drought responses possible. However, many modern water institutions lack drought management plans. Predicting drought and assessing impacts is feasible, but creating and adopting drought management plans is more complex. Drought management plans within the United States are developed as institutional rules, distinct from legislative policy making.

Several factors are likely to contribute to plan adoptions within water institutions, such as severity of drought, sophistication of institutions, and competing institutional agendas. The occurrence and severity of droughts should be the most prominent factors contributing to plan adoption. However, previous research has shown that the problem of drought alone is not sufficient to drive policy adoption (Wilhite & Rhodes, 1994).

Institutional policies or rules are influenced by many factors (Ostrom, 2004). These factors include institutional actors, implementation environment, and exogenous shocks such as natural disasters and scandals (Cohen, March, & Olsen, 1972; Pierson, 2000; Weingast & Marshall, 1988). These factors can exert influence at different stages within the policy process, from problem definition through ultimate policy implementation (Brewer, 1974).

Debates about the ultimate power of decision-making related to policy adoption also vary between elitist and populist typologies (Lowi, 1964). One would expect drought management policy adoption to be the domain of technical and political elites, given the technical complexity of the subject and options for mitigation. However, drought management policies are redistributive and designed to allocate resources during times of

scarcity. This policy type is indicative of an arena for interest group action (Lowi, 1972; Howlett & Ramesh, 2003). While climatic condition is the most obvious factor to influence government attention to drought management policy, the policy science literature suggests that issue salience, interest group influence, and environmental factors play a significant role (Burstein, 2003; Browne, 1990; Gormley, 1986).

At the macro level, drought management polices appear to be a fairly neutral subject that is unlikely to be a salient topic outside of a recent drought period. The salience of the topic increases as drought conditions worsen and policy actors are forced to respond. After learning from the drought experience and responding to constituency concerns, policies are developed and adopted to better prepare for the next occurrence. Policies likely will not be adopted outside of previous drought periods, given competition of policy space and capacity of institutions to respond to multiple policy issues (Kingdon, 1994).

At the micro level, drought management polices allocate resources in times of scarcity. During times of scarcity, the previous description of a neutral policy topic is easily dismissed. Policy arising from scarcity is redistributive in nature and assigns benefits and costs to different interests. Interest groups with significant stakes in the distribution will play an active role in the policy debate and will seek to minimize their uncertainty. As the salience of the issues increase, interest groups will engage in the institutional dialogue to ensure favorable outcomes.

As argued in previous chapters, the implementation environment for water institutions contributes to their performance. Adoption of drought management plans is an institutional policy output resulting from an implementation environment with a concentrated level of institutional actor agreement on policy values and a high level of certainty about impacts of policy actions. This implementation environment corresponds

with Administrative Institutions and represents conditions sufficient for drought management plan adoption.

Hypotheses and Methodology

The redistributive nature of drought management plans creates significant interest among users who would be most at risk during drought. Heckathorn and Maser (1990) argue that redistributive policies result because private individuals who are unable to resolve conflicts request government intervention to assist with resolutions. This description suggests that institutional actors most affected by drought need intervention to resolve conflicts over distribution of water during drought periods. Based on this construct, and targeting agricultural production as a key institutional actor significantly impacted by water shortages, these actors will share a concentrated agreement on the policy value of security. These actors will only support drought management plans that provide security for their economic interest. Without direct observable data to measure concentrated agreement on policy values, I propose that the level of agricultural production within a state is representative of a concentrated group of institutional actors within water institutions. Therefore, the first condition of an implementation environment related to Administrative Institutions is satisfied by the following hypothesis:

> H1: States with significant agricultural production in relation to total state economy will be more likely to adopt drought management policies.

The second condition for an implementation environment related to Administrative Institutions requires a high level of agreement on knowledge of proposed policy impacts.

Drought management plan adoption provides a unique case in which to study uncertainty during policy implementation. As stated before, many factors are at work within water institutions that affect the institutional governance paradigms. Adoption of a drought management plans provides improved clarity on the priority of water allocation for institutional actors. This priority of allocation is rooted in the statutory history of water law within the United States. A full exposition of this history is beyond the scope of this chapter, but is simplified into two categories: prior appropriation doctrine and riparian doctrine (Matthews, 2003). Riparian doctrine was the common foundation for water rights in the United States prior to westward expansion. The riparian doctrine assumes sufficient water to be available for all potential uses, thus granting water rights of reasonable use to any property owner with land adjacent to the water source. Prior appropriation doctrine was developed during westward expansion of the United States because water sources were limited. The prior appropriation doctrine allocates water rights based on priority of beneficial use, often described as "first in time, first in right"(Matthews, 2003, pg. 40). A primary difference between the two doctrines is that the riparian doctrine is less clear about priority of users and their allocation, while the appropriation doctrine provides temporal priority to users and their allocation. Given these conditions, states whose water rights originated in prior appropriation doctrine are more likely to have agreement on knowledge of policy impacts related to water allocation. Therefore, the second condition of an implementation environment related to Administrative Institutions is satisfied by the following hypothesis:

> H2: States with prior appropriation doctrine water rights are more likely to adopt drought management plans than states whose water rights originated in riparian doctrine.

Model Specifications and Measurement

In order to test the proposed hypotheses, I use a probit model to test for conditions of implementation environments associated with Administrative Institutions. The model also addresses issues of temporal variation by examining presence of implementation factors during the period of 1975–2005. The time period was chosen to reflect sufficient duration of time for policy change and coverage of drought management plan adoption among the forty-eight states included in the analysis. The probit specification was selected and estimated with maximum likelihood techniques to account for the binary outcome of drought management policy adoption. The estimation process is similar to event history analysis used to look at innovation among states. The technique examines the likelihood that a unit of observation will take a certain action at a given time under a given set of conditions. Because the probability function is not directly observable, an indirect observed dichotomous variable is used for analysis. The proposed model is as follows:

$$\text{Plan Adoption}_{i,t} = \Phi(b_0 + b_1\text{Policy Values}_{i,t} + b_2\text{Policy Knowledge}_{i,t} + b_{n+1}\text{Controls}_{i,t} + e_{i,t})$$

In this analysis, states are the unit of observation with the time period represented by years. The event is adoption of a drought management plan at a given period in time.

Data

Data was obtained from multiple existing sources and combined to create a pooled cross-sectional time series of relevant variables for the period of 1975 to 2005. The data includes discrete observations for forty-eight states over the thirty-year period. Drought conditions for the forty-eight states included in the study were obtained from the National

Oceanic and Atmospheric Administration. Hawaii and Alaska are excluded from this study due to lack of similar drought index measures.

The following variables are included in the model:

Dependent Variable

Plan Adoption: The dependent variable for the model represents if a state water institution has adopted a drought management plan. Data for adoption of drought management plans was obtained from individual review of the National Drought Mitigation Center's archive of state drought management policies. Plans were evaluated to establish their original adoption dates. States were coded with a one for the first year of adoption and one for each subsequent year after policy adoption[4]. As of 2005, forty states, including Hawaii, had adopted a drought management policy.

Independent Variables

Policy Values: This measure is a proxy variable for level of concentrated agreement on policy values. The variable represents the percent of state gross domestic product (GDP) associated with the industrial classification category for farms and crop production. Data was obtained from the United State Department of Commerce Bureau of Economic Analysis for the period of 1975 to 2005. This data was divided by the total state GDP for the same period to determine percentage of GDP associated with agricultural industry most susceptible to drought impacts.

[4] Most state drought management polices made historical reference to previously adopted government initiatives. The earliest formal drought management plan policy adoption date was used in the variable. Some of these dates did not correspond with states identified in Wilhite (1994).

Policy Knowledge: This variable is a surrogate for measuring the level of agreement on policy knowledge based on historical statutory water rights. An assumption is made that the historical foundation for water rights within a state is indicative of level of agreement between institutional actors on policy impacts to changes in water allocation. States that operate under riparian doctrine are coded as zero, meaning that there is less agreement on knowledge of drought plan impact. States that operate under prior appropriation doctrine are coded as a one, meaning that there is a high level of certainty on drought plan impacts. This rationale is based on the fact that prior appropriation states operate under water allocation that governs who has superior water rights. Data on predominant types of water rights was compiled from Goldfarb (1984).

The model includes controlling variables to account for other factors that are likely to influence adoption of drought plans. These include a series of drought indicators, state GDP, population density, population growth, time, and climate regions within the United States. A complete description of each control follows.

Drought Indicators: Variables are included to reflect the different durations of drought severity. The variables were created from historical data of the Palmer Series Drought Index (PSDI) and Palmer Hydrological Drought Index (PHDI) obtained from National Oceanic and Atmospheric Association (NOAA). NOAA's dataset includes monthly measures of drought severity from 1895 to present for each climate division within the forty-eight contiguous states. NOAA provides monthly state values based on averages of monthly climate regions within a state. A subset of data was selected for the period of 1975 to 2005 and annual drought conditions averages for each state were calculated. Meteorological drought (PDSI) measures the period

of dry spells within a climate region. Hydrological drought (PDHI) measures the period of water shortages within a climate region. The severity of drought is measured on a scale ranging from –7 to 7, with 0 being normal rain conditions and negative values measuring severity of drought. Moderate drought ranges from –2.0 to –3.0, severe drought ranges from –3.0 to –4.0, and the values of extreme drought are –4.0 or lower. The selected data was manipulated to create variable that provided PDSI averages for each year, previous three years, five years, and ten years to account for the temporal impacts of drought. Averages that show presence of drought for multiple years have a greater impact than a single event.

State Gross Domestic Product: This measure is the total annual dollar value, measured in millions, of total goods and services produced in a state. Data was obtained from the United State Department of Commerce Bureau of Economic Analysis for the period of 1975 to 2005.

Population Density: The population density for each state was created from data from the State Politics and Policy Quarterly Data Resource at the University of Kansas and population estimates from the United States Census Bureau. The measure was calculated by dividing the population in a given year by the land area of each state.

Population Growth: Population growth for each state was created from data from State Politics and Policy Quarterly Data Resource at the University of Kansas and population estimates from the United States Census Bureau. The measure was calculated by dividing the current year's population by the previous year's population.

Time: A count variable for time was included to control for effects of time across states. Values range from one to thirty years.

Climate Regions: This variable accounts for climate regions within the United States as established by the National Climatic Data Center. Nine regions are included.[5]

Table 5.1 Descriptive Statistics of Explanatory Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Policy Values (Agriculture Percentage of Total GDP)	2.26	2.77	0.06	25.22
Policy Knowledge (Water Law)	0.36	0.48	0	1
Meteorological Drought Duration (Years)				
Annual Average				
Three-Year Average	0.51	1.50	–5.05	6.41
Five-Year Average	0.55	1.21	–4.47	6.19
Ten-Year Average	0.49	0.75	–2.06	4.69
Hydrological Drought Durations (Years)				
Annual Average	0.59	2.16	–6.11	7.13
Three-Year Average	0.61	1.61	–5.05	6.41
Five-Year Average	0.65	1.28	–4.38	6.19
Ten-Year Average	0.69	0.78	–2.06	4.82
State Gross Domestic Product	123.78	172.82	2.82	1,616.35
State Percent Agricultural GDP	0.02	0.02	0.01	0.25
Population Density (Persons/sq. mile)	169.14	236.04	1.5	1,159.14
Population Growth (%)	0.01	0.01	-0.06	0.12
N=1,483				

[5] The nine climate regions and associated states are as follows: ***Northeast Region***: CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, and VT; ***East North Central Region***: IA, MI, MN, and WI; ***Central Region***: IL, IN, KY, MO, OH, TN, and WV; ***Southeast Region***: AL, FL, GA, NC, SC, VA; ***West North Central Region***: MT, NE, ND, SD, and WY; ***South Region***: AR, KS, LA, MS, OK, and TX; ***Southwest Region***: AZ, CO, NM, and UT; ***Northwest Region***: ID, OR, and WA; ***West Region***: CA, and NV.

Table 5.2 Probit Model Implementation Factors Effects on Drought Management Plan Adoption.

Variable		
Policy Values		–0.27
		(0.22)
Policy Knowledge		14.86
		(0.00)**
Meteorological Drought Duration		
	Annual Average	–0.08
		(0.92)
	Three-Year Average	1.07
		(0.30)
	Five-Year Average	–1.23
		(0.49)
	Ten-Year Average	–1.68
		(0.64)
Hydrological Drought Duration		
	Annual Average	–0.22
		(0.78)
	Three-Year Average	–0.67
		(0.50)
	Five-Year Average	0.94
		(0.55)
	Ten-Year Average	1.22
		(0.71)
State Gross Domestic Product (GDP)		0.00
		(0.11)
Population Density		–0.01
		(0.78)
Population Growth		–10.99
		(0.59)
Constant		13.28
		(0.00)**
Chi^2		572.71

* Significant at 5%, ** Significant at 1%

Results

I find that level of agreement on knowledge of policy impacts has an effect on drought plan adoption, but the model does not find support for the measure of agreement on policy values. Table 5.2 shows that agreement on knowledge of policy impacts increases the likelihood of a state adopting a drought policy. This supports the hypothesis that states

whose water law originates from the prior appropriation doctrine are more likely to agree on the impacts of a drought management plan.

I did not find support for the measure of agreement on policy values. This finding is likely more attributable to the measure used for agreement on policy values than an absolute refutation of the hypothesis that concentrated levels of agreement on policy values will yield plan adoption. The surrogate measure reflects level of economic output for agricultural farming and played out to not be a good measure of policy value agreement. A more direct measure is not available for the time series, thus limiting the model's ability to fully examine the hypothesis.

Overall the model results shed light on factors at work during implementation. Agreement on policy values and agreement on knowledge of policy impacts are key attributes that identify governance structures at work during implementation. Implementation environments that operate under concentrated agreement on policy values and agreement on knowledge of policy impacts are suitable environments for Administrative Institutions. This type of environment is typical under drought management plans, in which institutions provide strict instructions on water use during the drought period.

Conclusion

This chapter has examined the relationship between implementation environments and Administrative Institutions using the Implementation Framework for Institutional Analysis. I have shown that agreement on policy knowledge increases institutional performance as measured through policy outputs of drought management plans. Agreement on policy values also plays a key role. However, the proposed measure for policy value agreement was insufficient for the modeling approach used.

Clearly, increasing agreement on policy knowledge and values will improve institutional performance. While the reality is that few policy problems will be able to meet these requirements, the Implementation Framework for Institutional Analysis provides better understanding of the relationship between implementation environments and institutions. Additional work is needed to explore linkages between other implementation environments and institutions.

CHAPTER 6

Conclusions and Future Implications

Introduction

This dissertation demonstrates how a policy implementation perspective provides new insights for institutional analysis. The Implementation Framework for Institutional Analysis (IFIA) described and examined in the previous chapters is supported by empirical analysis as well as a historical view of institutional change. This finding is significant because it demonstrates the impact of policy implementation environments on institutional performance. Just as the Ancient Mariner lamented about thirst while gazing at the bounty of the ocean, ineffective institutions likely suffer from a mismatch between mode of governance and their implementation environment. The IFIA improves and expands upon existing institutional analysis frameworks, such as the Institutional Analysis and Development Framework, by simplifying measures of exogenous influences on institutions through a policy implementation approach. In addition to the reduction in variables, the IFIA provides insight into expected performance of institutions, institutional change, and suggestions on conditions necessary to meet policy objectives.

While this study focused on water institutions, scholars, policy makers, and institutional actors can benefit from further application of this framework. Specifically, the Implementation Framework for Institutional Analysis (IFIA) shed light on the following research questions:

1. What types or modes of governance for institutions are present during different policy implementation environments?
2. What is the relationship between implementation environments and institutional performance?
3. Is the framework applicable to different levels and locations of agreement on policy values and how policy knowledge influences policy outputs within institutions?

The IFIA defines four modes of governance associated with the two policy implementation dimensions of policy value agreement and agreement on knowledge of policy impacts: Administrative Institutions, Political Institutions, Networked Institutions, and Symbolic Institutions. The implementation framework and institutional typologies build on previous implementation frameworks (Matland, 1994; Hill & Hupe, 2009; Hoppe, 1999) and provide a direct linkage for institutional analysis. This linkage is important because the findings allow for further exploration of performance prescriptions proposed in Matland's (1994) ambiguity-conflict model. Political Institutions need powerful institutional actors to overcome conflicts and reach policy objectives. Networked Institutions require multiple approaches to satisfy the contextual conditions of a broad base of institutional actors. Symbolic Institutions require coalition strength to build support for their policy goals. Administrative Institutions require resources to be applied toward the policy objective. Each of these modes of governance provides a testable relationship between implementation environments and institutional performance. These implementation–prescription relationships can provide additional insight into potential causal factors of institutional performance.

The dimensions of agreement–on–policy–values (policy values) and agreement–on–knowledge–of–policy–impacts (policy knowledge) reflect the attributes of decision making within institutions related to a policy objective. Understanding the influence of these two dimensions is an important feature for institutional design and performance. As shown in the investigation on water scarcity, the level of agreement on policy knowledge increased the likelihood that the water institution reduced water scarcity.

In addition to the implementation-performance relationship, the review of institutional performance in Chapters 4 and 5 demonstrated that the IFIA framework is applicable to multiple levels of institutional analysis. The scalability of the framework makes it useful for investigations at the individual, organizational, and constitutional level of institutional analysis. This feature positions the IFIA to be a complementary tool to frameworks such as Ostrom's Institutional Analysis and Development (IAD) Framework. The IFIA provides more parsimonious dimensions for exogenous influences as compared to the three dimensions used for the IAD's action arenas. The IFIA reduces exogenous influences into two discrete factors that represent core attributes at work in policy implementation environments.

Summary of Key Implications of the Study

The IFIA has important theoretical application by its focus on two central aspects of institutional decision-making and performance: agreement on policy values and agreement on knowledge of policy impacts. The level and locus of agreement on policy values among institutional actors is significant given the complexity of decision-making related to policy goals and solutions. Agreement on policy knowledge is critical because of the degree of uncertainty that exists regarding policy solutions. The interaction of these two dimensions

highlights the modes of institutional governance and opens the window for further exploration of institutional performance. Institutional scholars can use the modes of governance and implementation environments as ideal types for developing prescriptions to improve institutional performance. The IFIA framework can also be used to identify existing institutional forms and better understand institutional change in dynamic policy implementation environments.

The IFIA provides a policy implementation framework to examine institutional performance and change that complements traditional economic models of institutional analysis. The IFIA also allows for the narrative exploration of institutional change based on transforming implementation environments. The narrative on the evolution of water institutions provided traction for the parsimonious development of the IFIA framework. The narrative is important for understanding that institutions are by their very nature dynamic. These changes are brought on by decision-making driven by policy values and policy knowledge. For the early hydraulic societies, when Administrative Institutions wielded power, values and knowledge were concentrated in a narrow hierarchy of power. As the implementation environment shifted for water institutions, policy values and policy knowledge changed. These changes brought about Symbolic Institutions. During this period policy values were shifting and policy knowledge was evolving. Two major drivers of the evolution were professional development within the field of water management and the need to harness water for economic development. As institutional power grew among water professionals, the environmental movement built coalition strength and changed the implementation environment. The environmental movement ushered in Political Institutions with concentrated agreement on policy values and continued disagreements on the impacts of water policy. Recently, the growth of globalism within the field of water and the rise of

integrated water management (IWM) has changed the implementation environment again. The new environment needs Networked Institutions to manage the broad spectrum of policy values at work, while benefiting from consensus on IWM as an effective policy tool.

The IFIA affords analysis of institutional forms, change, and performance. With dimensions of policy values and policy knowledge as key attributes of policy implementation environments, the implementation framework is applicable to the multi-governance nature of public institutions. As Matland , Hill & Hupe, and Koppenjan & Kijlin proposed, implementation is about decision making at multiple levels of governance under differing conditions of uncertainty. The IFIA has empirical support for applicability to both national and state level institutions. While this dissertation only examined state and national institutions, the dimensions of the implementation framework are expected to be useful for any level of institutional actor, including individuals and organizations.

The scalability of an implementation framework is necessary for any analysis of institutional design, given the multi-level governance environment. Specifying the correct institutional form is critical to improving institutional performance (Conca, 2006). Institutional scholars can benefit from this framework because it helps to provide a platform for integrating the policy implementation environment into institutional design. This feature is important because institutions are rarely created anew, but are more likely an evolution or offshoot of an existing institution. Specifying the correct changes to these institutions requires understanding the implementation dimensions of agreement on knowledge and values.

Limitations of Research

The empirical approach used for the evaluation of the IFIA highlights the difficulties in performing institutional analysis. The scholarly definitions of institutions and governance display the complexity of modeling institutional attributes. The attributes of rules, rights, norms, and processes make reduction to measurable indicators of institutional form a trying task. The two major limitations of this work are inability to directly quantify dimensional scales for the implementation environments and absence of performance comparison between implementation environments.

First, the empirical approached used to test the implementation dimensions of policy values and policy knowledge was practical given the data available. However, the data used were proxy measures for policy values and policy knowledge and not collected specifically for this inquiry. A more robust analysis would use data that includes direct measures of policy values and policy agreement. The lack of a dimensional scale reduces the clarity of specifying the divisions between implementation environments. Creation of direct measures would enhance the framework's ability to have a testable scale that could be used to assess the relative position of institution within one of the four policy implementation settings.

Second, the addition of scales for both implementation dimensions would greatly enhance the applicability of the framework for comparative institutional analysis. The current form of the IFIA proposes relationships between implementation environments and institutions, but it limited in its current form to quantify performance between implementation environments. The initial framework suggests that poor institutional performance is expected for a misalignment between institutional design and implementation environment. However, the frameworks current form does not provide a

testable hypothesis for assessing which institutions yield the best performance. This relationship needs further exploration and quantification.

Implications for Additional Research

The IFIA is a policy implementation framework for institutional analysis. Pressman and Wildavsky (1973) were the first to recognize and describe the importance of implementation environments on institutional performance. As noted in their often-cited investigation, the implementation environment can exert significant influence, both positive and negative, on policy objectives. For example, local coalitions opposed to large-scale water supply projects were able to change institutional actions and end the era of big dam construction as a solution to water supply (Conca, 2006). This example and others presented in the dissertation echo Wildavsky's message that "implementation matters" and emphasize the importance of linkages between policy implementation and institutional analysis.

The empirical work within this dissertation provides support for the IFIA framework. While the initial results are encouraging, it is also clear that more empirical testing is need for further validation of the framework. Without direct measures for the policy implementation dimensions, causal statements on relationships between policy implementation environments and institutional performance are weakened.

While this work builds on previous examinations of policy implementation and institutional analysis, the IFIA provides specific traction for a parsimonious tool to link implementation environments and institutional performance based on decision-making attributes of agreement on policy knowledge and policy values. I hope that future research can draw from this humble proposal to study how the interactions between implementation decision-making attributes influence institutions and their evolution. Specifically, research

that can define scales for each dimension will allow for systematic comparison of institutions across multiple policy areas.

REFERENCES

Acheson, J. M. (1994). *Anthropology and Institutional Economis* (Vol. No. 12). New York: University Press of America.

Alston, L. J., Thrainn, E., & North, D. C. (1996). *Empirical Studies in Institutional Change*. Cambridge ; New York: Cambridge University Press.

Amery, H. A. (2000). Water conflict: Economics, politics, law and Palestinian-Israeli water resources. *Middle East Journal, 54*(1), 140-142.

Araral, E. (2010). Improving effectiveness and efficiency in the water sector: institutions, infrastructure and indicators. [Article]. *Water Policy, 12*, 1-7.

Baker, M. N. (1949). *The quest for pure water; the history of water purification from the earliest records to the twentieth century*. United States.

Bakker, K. J. (2003). From public to private to ... mutual? Restructuring water supply governance in England and Wales. *Geoforum, 34*(3), 359-374.

Barry, M., & Hughes, J. M. (2008). Talking Dirty , The Politics of Clean Water and Sanitation. *The New England Journal of Medicine, 359*(8), 784-787.

Bartram, J., & Cairncross, S. (2010). Hygiene, Sanitation, and Water: Forgotten Foundations of Health. *PLoS Med, 7*(11), e1000367.

Baumgartner, F. R., & Jones, B. D. (1993). *Agendas and instability in American politics*. Chicago: University of Chicago Press.

Blomquist, W., Heikkila, T., & Schlager, E. (2004). Building The Agenda for Institutional Research in Water Resource Management. *JAWRA Journal of the American Water Resources Association, 40*(4), 925-936.

Brichieri-Colombi, S. (2009). The world water crisis: The failures of resource management (Vol. 14). New York: I. B. Tauris.

Clague, C. K. (1997). *Institutions and economic development: growth and governance in less-developed and post-socialist countries*. Baltimore: Johns Hopkins University Press.

Comittee, G. W. P.-T. A. (2000). *Intergrated water resources management*. Stockholm: GWP.

Conca, K. (2006). *Governing water contentious transnational politics and global institution building*. Cambridge, MA: The MIT Press.

Cook, K. S., & Levi, M. (1990). *The Limits of rationality*. Chicago: University of Chicago Press.

Cumming, O. (2009). The sanitation imperative: A strategic response to a development crisis. *Desalination, 248*(1), 8-13.

Daoudy, M. (2008). Hydro-hegemony and international water law: Laying claims to water rights. *Water Policy, 10*, 89-102.

DeLeon, P., & DeLeon, L. (2002). What ever happened to policy implementation? An alternative approach. *Journal of Public Administration Research and Theory, 12*(4), 467.

Easton, D. (1965). *A systems analysis of political life*. New York,: Wiley.

Evans, T., & Wilson, P. (1992). Regime theory and the English school of international relations: A comparison. *Millennium-Journal of International Studies, 21*(3), 329.

Feldman, D. L. (2007). Water policy for sustainable development (pp. xiii, 371 p.). Baltimore: Johns Hopkins University Press.

Figuères, C., Rockström, J., & Tortajada, C. (2003). *Rethinking water management: Innovative approaches to contemporary issues*. London: Earthscan Publications.

Fischhendler, I. (2008). Institutional conditions for IWRM: The Israeli case. *Ground Water, 46*(1), 91-102.

Gleick, P. H. (2000). *The world's water 2000-2001*. Washington, DC: Island Press.

Gleick, P. H. (2009). *The world's water 2008-2009*. Washington, DC: Island Press.

Glennon, R. J. (2009). *Unquenchable: America's water crisis and what to do about it*: Island Pr.

Goggin, M. L. (1986). The" too few cases/too many variables" problem in implementation research. *Political Research Quarterly, 39*(2), 328.

Goggin, M. L. (1990). *Implementation theory and practice: Toward a third generation*. Glenview, IL: Scott, Foresman/Little, Brown Higher Education.

Goldfarb, W. (1984). Water law (pp. xx, 233 p.). Boston: Butterworth.

Groenfeldt, D., & Svendsen, M. (2000). Case studies in participatory irrigation management. Retrieved June 1, 2011, from www.netlibrary.com/urlapi.asp?action=summary&v=1&bookid=33284

Heckathorn, D. D., & Maser, S. M. (1990). The Contractual Architecture Of Public-Policy - A Critical Reconstruction Of Lowis Typology. *Journal Of Politics, 52*(4), 1101-1123.

Hey, C. (2005). EU Environmental Policies: A short history of the policy strategies. *EU Environmental Policy Handbook: A Critical Analysis of EU Environmental Legislation, Brussels: European Environmental Bureau*.

Hill, C. J., & Lynn, L. E. (2005). Is hierarchical governance in decline? Evidence from empirical research. *Journal of Public Administration Research and Theory, 15*(2), 173.

Hill, M., & Hupe, P. (2003). The multi-layer problem in implementation research. *Public management review, 5*(4), 471-490.

Hill, M. J., & Hupe, P. L. (2009). *Implementing public policy: An introduction to the study of operational governance* (2nd ed.). Los Angeles, CA: SAGE.

Hoppe, R. (1989). *Het beleidsprobleem geproblematiseerd: over beleid ontwerpen en probleemvorming*: Coutinho.

Hoppe, R. (1999). "'Policy analysis, science, and politics: from" speaking truth to power" to" making sense together"'. *Robert Hoppe*, 1.

Hurrell, A. (1993). *International Society and the study of Regimes. A reflective Approach.*: Oxford University Press.

Iyer, R. R. (2007). Towards water wisdom: Limits, justice, harmony. Available from http://public.eblib.com/EBLPublic/PublicView.do?ptiID=409086

Kingdon, J. W. (2003). *Agendas, alternatives, and public policies* (2nd ed.). New York: Longman.

Koppenjan, J. F. M., & Klijn, E.-H. (2004). Managing uncertainties in networks a network approach to problem solving and decision making

Krasner, S. D. (1982). Structural causes and regime consequences: Regimes as intervening variables. *International Organization, 36*(2), 185-205.

Lasswell, H. D. (1956). *The decision process: seven categories of functional analysis*: Bureau of Governmental Research, College of Business and Public Administration, University of Maryland.

Le Moigne, G. A. S. M. Z. S. G. (1994). *A guide to the formulation of water resources strategy*. Washington, D.C.: World bank.

Lindblom, C. E., & Woodhouse, E. J. (1993). *The policy-making process*: Prentice Hall Englewood Cliffs, NJ.

Linton, J. (2010). *What is water? The history of a modern abstraction*. Vancouver, BC: UBC Press.

Lipsky, M. (1980). *Street-level bureaucracy : dilemmas of the individual in public services*. New York: Russell Sage Foundation.

Loucks, D. P. (2003). Managing America's rivers: Who's doing it? *International Journal of River Basin Management, 1*(1), 21-31.

Lynn, L. E., Heinrich, C. J., & Hill, C. J. (2001). *Improving governance : a new logic for empirical research*. Washington, D.C.: Georgetown University Press.

Lynn, L. E., Heinrich, C. J., & Hill, C. J. (2002). *Improving governance: A new logic for empirical research*: Georgetown Univ Pr.

Matland, R. E. (1995). Synthesizing the implementation literature: The ambiguity-conflict model of policy implementation. *Journal of Public Administration Research and Theory, 5*(2), 145-174.

Meinzen-Dick, R. (2007). Beyond panaceas in water institutions. *Proceedings of the national Academy of sciences, 104*(39), 15200.

Merriam-Webster. (2007). Merriam-Webster's dictionary and thesaurus (pp. 940). Springfield, MA: Merriam-Webster.

Missy, R. (2011). Afghanistan faces prospect of serious drought in 2011; Millions already rely on global food aid. *The Ottawa Citizen,* p. F.8.

Molle, F. (2006). *Planning and managing water resources at the river-basin level: emergence and evolution of a concept*: Comprehensive Assessment of Water Managemet in Agriculture.

Nakamura, R. T. (1987). The textbook policy process and implementation research. *Review of Policy Research, 7*(1), 142-154.

North, Douglass C. (1990). *Institutions, institutional change, economic performance*. New York: Cambridge University Press.

O'Toole, L. J. (1986). Policy recommendations for multi-actor implementation: An assessment of the field. *Journal of public policy, 6*(02), 181-210.

O'Toole, L. J. (1993). Multiorganizational policy implementation: some limitations and possibilities for rational-choice contributions. *Scharpf, FW, Games in hierarchies and networks, Frankfurt a. M*, 27-64.

O'Toole, L. J. (2000). Research on policy implementation: Assessment and prospects. *Journal of Public Administration Research and Theory, 10*(2), 263.

Ostrom, E. (1991). *Governing the commons : the evolution of institutions for collective action*. Cambridge [England] ; New York: Cambridge University Press.

Ostrom, E. (1992). *Crafting institutions for self-governing systems*.

Pacey, A. (1983). *The culture of technology*: MIT Press.

Peters, B. G., & Pierre, J. (1998). Institutions and Time: Problems of Conceptualization and Explanation. *Journal of Public Administration Research and Theory, 8*(4), 565-584.

Picciotto, R. (1995). *Putting institutional economics to work: from participation to governance* (Vol. 304): World Bank Publications.

Pressman, J. L., & Wildavsky, A. B. (1979). *Implementation: How great expectations in Washington are dashed in Oakland* (2nd ed.). Berkeley, CA: University of California Press.

Pressman, J. L., Wildavsky, A. B., & Oakland Project. (1973). *Implementation: how great expectations in Washington are dashed in Oakland; or, Why it's amazing that Federal programs work at all, this being a saga of the Economic Development Administration as told by two sympathetic observers who seek to build morals on a foundation of ruined hopes*. Berkeley,: University of California Press.

Rijsberman, F. R. (2006). Water scarcity: Fact or fiction? *Agricultural water management, 80*(1-3), 5-22.

Robichau, R. W., & Lynn, L. E. (2009). The implementation of public policy: Still the missing link. *Policy Studies Journal, 37*(1), 21-36.

Sabatier, P. A. (1986). Top-down and bottom-up approaches to implementation research: a critical analysis and suggested synthesis. *Journal of public policy, 6*(1), 21-48.

Sabatier, P. A. (1991). Toward better theories of the policy process. *PS: Political Science and Politics, 24*(2), 147-156.

Sabatier, P. A., & Jenkins-Smith, H. C. (1993). *Policy change and learning: An advocacy coalition approach*. Boulder, CO: Westview Press.

Saleth, R. M., & Dinar, A. (2004). *The institutional economics of water: A cross-country analysis of institutions and performance*. Cheltenham, UK: Edward Elgar Publishing.

Solomon, S. (2010). *Water: The epic struggle for wealth, power, and civilization*: Harpercollins.

Stakhiv, E. Z. (2003). Disintegrated water resources management in the US: Union of Sisyphus and Pandora. *Journal of Water Resources Planning and Management, 129*, 151.

Stone, D. A. (1989). Causal stories and the formation of policy agendas. *Political science quarterly, 104*(2), 281-300.

Tirado, M. C., Cohen, M. J., Aberman, N., Meerman, J., & Thompson, B. (2010). Addressing the challenges of climate change and biofuel production for food and nutrition security. *Food Research International, 43*(7), 1729-1744.

Troesken, W. (1999). Typhoid rates and the public acquisition of private waterwork, 1880-1920. *The Journal of Economic History, 59*(04), 927-948.

Trottier, J., & Slack, P. (2004). *Managing water resources past and present*. Oxford: Oxford University Press.

Varady, R. G., Meehan, K., & McGovern, E. (2009). Charting the emergence of 'global water initiatives' in world water governance. *Physics and Chemistry of the Earth, Parts A/B/C, 34*(3), 150-155.

Warner, J., & Zeitoun, M. (2008). International relations theory and water do mix: A response to Furlongís troubled waters, hydrohegemony and international water relations. *Political Geography, 27*(7), 802-810.

Werner, A. (2004). *A guide to implementation research*: Urban Inst Pr.

Whitford, A. B., Smith, H., & Mandawat, A. (2010). Disparities in access to clean water and sanitation: institutional causes. *Water Policy, 12*, 155-176.

Wilhite, D. (1997). *Improving drought management in the West: The role of mitigation preparedness*. Springfield, Virginia.

Wilhite, D. (2000a). *Drought a global assessment Volume I*. London: Routledge.

Wilhite, D. (2000b). *Drought a global assessment Volume II*. London: Routledge.

Wilhite, D. (2005). *Drought and water crisis: Science, technology, and management issues* (1 ed.). London: Taylor & Francis Group.

Wilhite, D. A., & Rhodes, S. L. (1994). State-level drought planning in the United States: Factors influencing plan development. *Water international, 19*(1), 15-24.

Wittfogel, K. A. (1957). *Oriental despotism: A comparative study of total power*. New Haven, CT: Yale University Press.