NOTE TO USERS

DISSERTATION

WATER POLICY IN SOUTH KOREA: TOWARDS A NEW PARADIGM

Submitted by:

Sung-Je Park

Department of Civil Engineering

In partial fulfillment of the requirements

for the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Fall 2004

COLORADO STATE UNIVERSITY

July 20, 2004

WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY SUNG-JE PARK ENTITLED "WATER POLICY IN SOUTH KOREA: TOWARDS A NEW PARADIGM" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

Committee on Graduate Work

Darrell G. Fontane

Scott T. Moore

Evan C. Vlachos

Adviser Neil S. Grigg

Department Head Sandra L. Woods

ABSTRACT OF DISSERTATION

WATER POLICY IN SOUTH KOREA: TOWARDS A NEW PARADIGM

This dissertation addresses the new paradigm, the driving forces, and the ongoing water policy changes in South Korea. Its goal is to analyze evidence from international and national perspectives of the new paradigm, regional water conflicts, and driving forces in South Korea to show why four major components of Integrated Water Resources Management (IWRM) – planning, pricing, public participation and water governance - are important and how they are changing water policy in South Korea.

The analysis includes reviews of water management experiences of the United States and South Korea to provide comparative perspectives and to identify and assess important factors for the new water paradigm in South Korea. It also discusses four major IWRM elements and five categories of driving forces to find further improvements needed to advance the practice of IWRM in South Korea. The final stage of the dissertation is to evaluate the overall water management practice and sectoral applications of the four major IWRM components in South Korea.

The dissertation compares water management practices in South Korea and the United States. The countries have different economic and political conditions, and they face

many similar needs, where new and more holistic thrusts are needed, including capacity–building and demand-side water management. The American experiences of water management strategies include voluntary, community-based, bottom-up and participatory approaches, and are very important for South Korea to understand the changing water paradigm and to adapt IWRM principles into its water policies.

Chapters 2, 3 and 4 discuss the international, national and local perspectives of water management. Chapter 2 reviews Chapter 18 of Agenda 21 suggested by the UNCED conference and presents four important IWRM components that are essential to understand the new water paradigm in South Korea. Chapter 3 compares management characteristics of the two countries based on analysis of water management at the national levels in South Korea and the United States, and at the state level in the United States. Chapter 4 identifies the outcomes of the new paradigm at work at the project levels in the two countries where two regional water projects, in different decades and different places, without apparent close relationships, were not completed.

Chapters 5 and 6 discuss five categories of driving forces and their affected outputs of IWRM applications in South Korea. Chapter 5 reviews the economic, political, social, environmental, and technological driving forces that led to the new water paradigm in South Korea. Chapter 6 focuses on the four principal IWRM components and reviews

three important water management practices initiated by the government (comprehensive water management measures and the Four Rivers Special Acts) and a voluntary local watershed movement (the Daepo stream case).

The overall evaluation in the dissertation includes the international and domestic issues. The international community rates South Korea as an excellent country in the overall water management performance. On the other hand, most of the Korean people are significantly critical to its international recognized achievements. The concluding chapter explains why there is a divergence in these international and domestic perspectives. It evaluates the water management practice of South Korea and suggests future improvements. Management mechanisms within sectors are generally improving their IWRM practices to reflect the changed environments. Three out of four components - planning, pricing, and public participation – are recognized as moving towards the new paradigm. The institutional frameworks of the fourth element - water governance - are also improving, but still remain under the influence of the old paradigm.

South Korea should enhance its social adaptive capacity by improving technical, social, and political capacities. Providing cooperation and coordination approaches also will be the necessary conditions to increase the social adaptive capacity. The initial phase of the demand-side management is not enough to prepare for the coming water scarcity deficit

period. Sustainable development can be attained through fully implementing the four principal IWRM components, and then South Korea can proceed to the phase of natural resource reconstruction.

Sung-Je Park
Department of Civil Engineering
Colorado State University
Fort Collins, CO 80523
Fall 2004

ACKNOWLEDGEMENTS

This dissertation is the result of more than twenty years of my experience in the field of water policy on the practical research work in South Korea, and later on the theoretical study work at Colorado State University (CSU) in the United States. My knowledge in the water policy area has been greatly enhanced with the help of many individuals during my study at CSU.

I am very grateful to my four committee members who are: Dr. Neil Grigg and Dr. Darrell Fontane in the Department of Civil Engineering, Dr. Evan Vlachos in the Department of Sociology, and Dr. Scott Moore in the Department of Political Science. I want to express my earnest appreciation to my academic advisor Dr. Neil Grigg, who always encouraged me to improve my understanding on water policy. He has patiently helped me over these years I have been with him.

I have learned a lot about the engineering approach to manage water resources from Dr. Darrell Fontane. Dr. Evan Vlachos enlightened me to look beyond the engineering-minded perspective towards the social science perspective. His diverse insights led me to the sphere of interdisciplinary management of water resources. Dr. Scott Moore gave

very important guidance in the political aspect of water management. All these diverse perspectives were essential for my understanding of the new water paradigm.

Special thanks go to my family. I will never forget their support during my study period. My wife Si-Saeng Ryu has been the most important contributor because she has always kept my family at peace and with joy. I appreciate my daughter Kye-Young (Kathy) and my son Dong-Kwan (Don) for their great jobs academically and socially despite my inability to care for them because of my studies.

I thank my relatives and friends for giving me encouragement as well. The Gaebler family has given endless support ever since we arrived in Fort Collins. Dr. Grant Lee and his wife Grace have cheered on my family during hard times.

I would also like to acknowledge Dr. Anthony Turton, GIBB-SERA Chair in IWRM of CSIR in South Africa, Dr. Leif Ohlsson, a researcher at the Department of Peace and Development Studies of University of Göteborg in Sweden, and the Oregon State University Press for giving me their permission to use their figures in my dissertation. I was also much inspired by the creative ideas of Drs. Turton and Ohlsson for my study.

From the help of all of these people and those I have not mentioned above, I was able to successfully graduate from CSU.

TABLE OF CONTENTS

1. Introduction

1.1. Problem statement

Economic development increases water demand and causes structural changes in water use, thus increasing competition and conflict among water users (WCD 2000, 4-5). Until the late 1980s, South Korea had focused on developing new water sources for economic development and population growth. As a growing industrial country, it needs new water infrastructure, but conflicts between environmental and developmental goals require new water policies and planning and decision-making approaches. In the 1990s, political actors, mainly environmental groups who were new to policy making in the water sector, succeeded in putting policy change on the agenda. This was made possible by economic modernization until the 1980s and by political democracy since 1987, which gave rise to activities of environmental groups.

South Korea is reforming its water policy by adopting a new water paradigm, which is required by changes in political, economic, and social environments since the 1960s. The reforms were also influenced by global opinions about water management and the environment. The water development ideology of South Korea must be adapted to sustainable development and reflect the changing paradigm from water development to water management. The new water paradigm must support needs for water supply, pollution control, flood control, and other purposes of water management, and be characterized by best practices in the basin wide approach, integrated management, and sustainable development.

1.2. Research objective

This dissertation addresses the new paradigm, the driving forces, and the ongoing water policy changes in South Korea. After a preliminary analysis, four major policy elements are selected for analysis: planning, pricing, public participation and water governance. These are consistent with the current findings of the United Nations about the importance of water governance (Szöllösi-Nagy, 2004; UNESCO 2003a, 370). These are also most urgent to reform existing institutional frameworks because the driving forces for the new paradigm are so strong that conflicts cannot be managed with traditional water policy mechanisms.

In the dissertation, I will review the evidence from international and national perspectives of the new paradigm, regional water conflicts, and the driving forces for the new paradigm to show why the four policy elements are important and how they are changing Integrated Water Resources Management (IWRM) in South Korea. I review the water management experiences of the United States at the national, state, and local levels as a case study to provide a comparative perspective for the Korean case and to identify factors for the new water paradigm in South Korea.

The central features of the dissertation are a comparative analysis of two failed reservoir schemes -Youngwol Dam in South Korea and Two Forks Dam in Colorado – addressed in chapter 4 and the new water paradigm in South Korea that is explained in chapter 6. In chapter 4, by focusing on the comparative analysis and how it was shaped by changing water policies in the two countries, one is able to see how the convergence of the driving forces makes a new water policy imperative in South Korea, especially in the areas that support water governance. In chapter 6, the global perspectives of the new

water paradigm – discussed in chapter 2 - are combined with the practical IWRM applications to understand the new water paradigm of South Korea.

1.3. Research plan

In the dissertation, chapters 2 and 6 deal with the new global paradigm and how it applies to South Korea. Chapters 3 and 4 review water management policies of South Korea and the United States at the national and local levels. Chapter 5 explains the driving forces of South Korea that lead to the new water paradigm. In this way, chapters 2, 3 and 4 review systematic perspectives of the new water paradigm at the international, national and local levels to enable the reader to understand the emerging new paradigm in managing the South Korean water resources that is explained in chapter 6.

Chapter 2 begins with definitions of paradigm, new paradigm, and paradigm shift, and then it reviews literature and international conference reports about the new water paradigm. Finally, the four principal elements that will be explained in chapter 6 are derived from Chapter 18 of Agenda 21 of the United Nations Conference on Environment and Development (UNCED).

Chapter 3 reviews the changing water paradigm at the national level and its impacts on water resources development and management in South Korea and the United States. It also discusses how water resources projects in the two countries are planned. Two levels of comparative analyses are included: the national levels for South Korea and the United States, and how South Korea compares to state-level water management for two states, California and Colorado. These enable a focus on South Korea as a fast developing and

newly democratized oriental country and the United States as a western nation with a history of economic and political stabilities.

Chapter 4 deals with regional water conflicts at the local level. It analyzes two failed water projects to review project level water management practices in detail. It finds a consistent paradigm shift from supply-side to demand-side water managements through identifying similar changing water management practices in different political systems. By explaining the changing paradigms at the international, national, and local levels in chapters 2, 3 and 4, the dissertation will then focus on the new water management paradigm in South Korea.

Chapter 5 deals with the driving forces that enable the paradigm shift in South Korea. The dissertation identifies five important economic, political, social, environmental, and technological driving forces.

In chapter 6, the dissertation focuses on the new water paradigm in South Korea. It reviews specific applications of the four main IWRM components and three water management practices in South Korea by looking back at the consistent changing paradigm in chapters 2, 3 and 4, and the driving forces in chapter 5. The reader will understand how the systematic perspectives of the new paradigm at the international, national, and local levels are reflected into the South Korean water policies.

In Chapter 7, the lines of analysis are brought together to show how the changing global paradigm and the driving forces within South Korea have created a need for the new paradigm. It then identifies for the four key elements how Korean water policy should evolve, including policies, elements, and roles of the key participants.

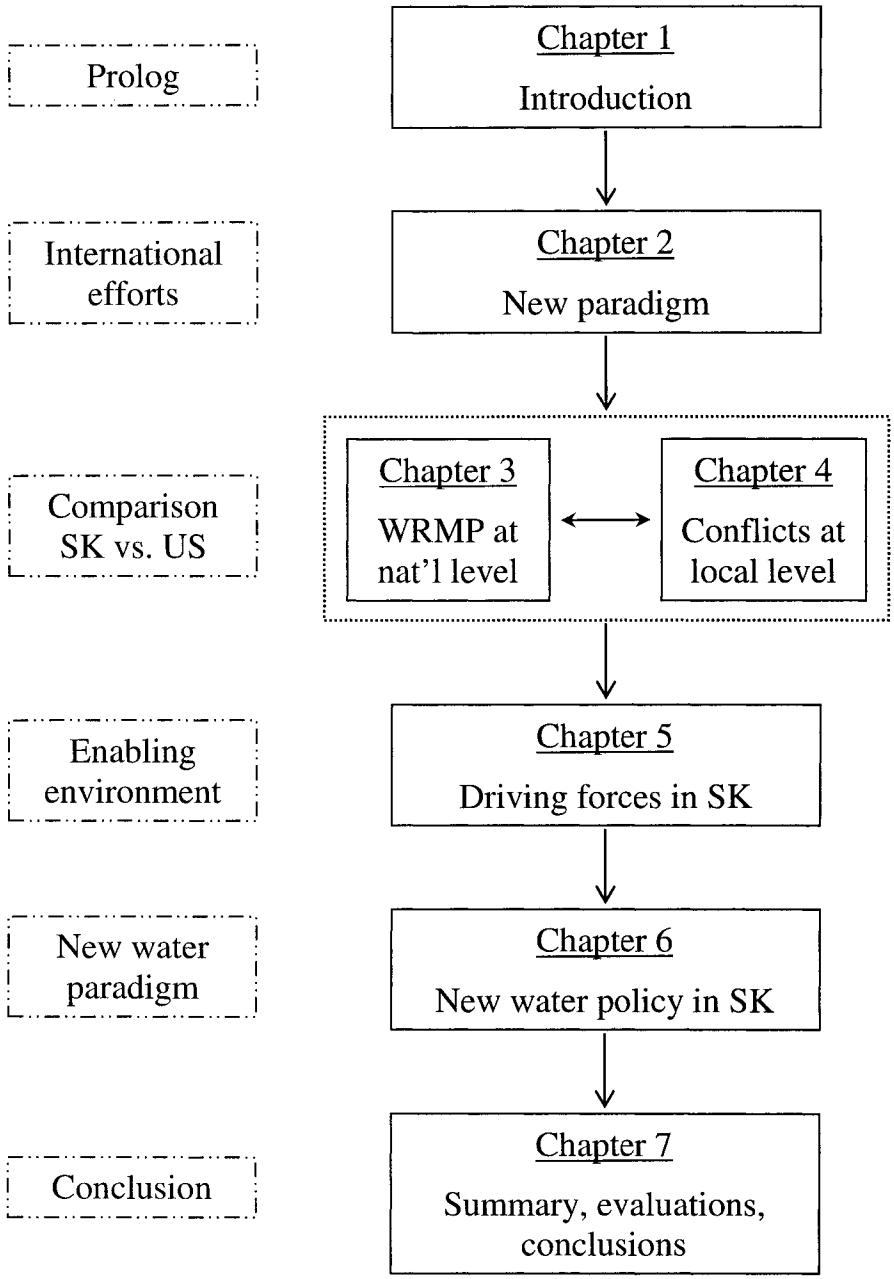

Figure 1-1 Flow chart of the research plan

Note: WRMP- Water resources management and planning; SK- South Korea; US- United States; nat'l- national.

2. Changing IWRM paradigm

2.1. Purpose of chapter

This chapter explains how the paradigms for water resources management in the world are converging toward a global consensus about an approach that is named Integrated Water Resources Management (IWRM). The goal of the chapter is to help the reader understand the evolution of the new water policy of South Korea explained in chapter 6.

The chapter consists of three parts. It begins with definitions of the terms paradigm, new paradigm, and paradigm shift. Then, it focuses on the international consensus in achieving the guiding principles of Chapter 18 of Agenda 21 and international efforts towards the new water paradigm. The third part transforms international perspectives in the second part into four main IWRM components (planning, pricing, public participation and water governance) that describe the new water paradigm of South Korea in chapter 6.

2.2. Concept of paradigm

The term *paradigm* is derived from the Greek word *paradeigma,* which means pattern (Capra 1988, 22). A paradigm is "an accepted model or pattern" (Kuhn 1970, 23) or "a set of assumptions, concepts, values, and practices that constitutes a way of viewing reality for the community that shares them, especially in an intellectual discipline." [1] It became popular after Kuhn published *The Structure of Scientific Revolutions* in 1962. He used it to denote "universally recognized scientific achievements that for a time provide

[1] *The American Heritage Dictionary of the English Language* (2000), 4th ed., s.v. "paradigm"; http://dictionary.reference.com/search?q=paradigm.

model problems and solutions to a community of practitioners" (Kuhn 1970, viii). It is also "a conceptual framework shared by a community of scientists and providing them with model problems and solutions" (Capra 1988, 22). While there are many concepts for the term paradigm, it is used here to simply mean a way of looking at things.

Another definition or explanation is that a paradigm implies "very different things" from the established framework (Sharrock and Read 2002, 31). Capra refers to a paradigm as "the totality of thoughts, perceptions, and values that form a particular vision of reality, a vision that is the basis of the way a society organizes itself" (Capra 1988, 22). Schultz (1998) defines that a paradigm is "a standard on the basis of which experience is compared and evaluated." He recognizes the paradigm as comprising all fundamental principles of a scientific discipline with regard to methodology and science subjects for a specific period.

It follows then that a new paradigm is a new way of looking at things. Kempton et al. (1995, 9) define that the term *new paradigm* is "a fundamentally different way of viewing the world" that is "incompatible with previous paradigms." It comes with development of new disciplines and specialties out of a pre-paradigmatic phase (Sharrock and Read 2002, 31). Thus it sometimes addresses complex problems which the old paradigm does not solve (ibid. 35).

A new paradigm requires the re-construction and the re-evaluation of the old paradigm to displace the latter by the former (Kuhn 1970, 7). When the paradigm changes the world literally changes to a completely different world. The new paradigm implies a new and more rigid definition of the world, thus it can transform a certain group into a profession or, at least, a discipline to displace the vested groups (Kuhn 1996, 19). A

successful introduction of the new paradigm requires the outcome of controversy as it can be installed at the expense of the established paradigm or the old paradigm. Such transformation or displacement is called a *paradigm shift* that means "the successive transition from one paradigm to another via revolution" (ibid. 12). Despite the fact that a paradigm shift is a usual developmental pattern in mature society, the successful transition to the new paradigm requires difficult and time consuming work (Sharrock and Read 2002, 35, 51; Kuhn 1996, 7).

2.3. New paradigm for IWRM

2.3.1. Components of the new paradigm

A paradigm shift in the water sector inevitably brings fundamental changes in water resources management because a new paradigm is "seldom or never just an increment to what is already known" and "its assimilation requires the reconstruction of prior theory and the re-evaluation of prior fact" (Kuhn 1970, 7). According to Schultz, the three criteria of economic benefit, technical efficiency, and performance reliability were enough under the old water paradigm. Four additional criteria are necessary with emergence of the new water paradigm: the principles of sustainable development, ecological quality, consideration of macro-scale systems and effects, and planning in view of changes in natural and socioeconomic systems (Schultz 1998, 37-8).

Gleick (2000) proposes several components of the new water paradigm: shifting away from seeking new water sources, growing emphasis on ecological values, re-emphasis on meeting basic water needs, use of non-structural alternatives, application of economic principles, and extensive public participation. Serageldin (1995) identifies four principles

of sound water management: the institutional principle (stakeholder involvement in balancing costs and benefits), the subsidiary principle (managing at the lowest level), the technical principle (effective resources allocation), and the instrument principle (user pays and polluter pays). He also suggests four overarching principles of long-term vision, comprehensive management, decentralization and stakeholder participation, and market and price mechanism to improve water resources management.

The World Commission on Dams (WCD) proposes an innovative and constructive new approach to address the dam debate caused by the traditional top-down and technology–focused approach. The new way suggested by WCD consists of seven strategic priorities: 1) gaining public acceptance, 2) comprehensive options assessment, 3) addressing existing dams, 4) sustaining rivers and livelihoods, 5) recognizing entitlements and sharing benefits, 6) ensuring compliance and 7) sharing rivers for peace, development and security. WCD also recommends 34 policy principles and 26 guidelines to effectively implement these seven strategic priorities for good practice[2] (WCD 2000, chapter 8, chapter 9).

According to the World Water Council (WWC), the broad and diverse thrusts from the international community are converging into five important norms[3]. They are the holistic and systemic approach, participatory institutional mechanisms, full-cost pricing of water services, institutional/technological/financial innovation, and governments as enablers. These norms are recognized to be achieved by both attitudinal shifts of the mobilization of political will and behavioral change by all (WWC 2000c, vi – vii).

---

[2] The environmental community and the academic circles are satisfied with the guidelines while the developing countries and the dam industry complain about the guidelines as unrealistic and too strict in the real world (Salman 2001, 283).

The new paradigm also emphasizes the human dimension or the growing role of people in effective water resources management. Such understanding can be achieved by a coordinated approach when transparent rules and regulations are properly provided and where various stakeholders participate. Thus, sustainable water management is not likely to come true with "business as usual," and without "making water everybody's business" and realizing the proper institutional framework on water (Lundqvist 2000, 198; WWC 2000a). The meaning of "making water everybody's business" can be viewed from the angle of active involvement. It implies a transition from the conventional perspective[4] into a new and completely different paradigm[5]. The government should provide the enabling environment to enhance active involvements of various stakeholders (Lundqvist 2000, 195-6).

Water policies have already changed in some countries or are subject to change in the rest of the world. Traditional patterns of water development need to be modified to reflect new perspectives of water conservation. Even though technological and other tangible features are still important, human dimensions and institutional issues now attract more attention in water policy decision-making process. Water problems are no longer regarded as resource or environmental issues per se, but considered institutional failures caused by improper interaction between society and the environment (ibid. 194-5). This concept is also consistent with the internationally recognized consensus (UNESCO 2003b, 4). Table 2-1 summarizes these components of the new water paradigm.

---

[3] They were suggested in *The World Water Vision Commission Report* (WWC 2000c) by Ismail Serageldin, the Chairman of World Commission for Water in the 21st Century.

[4] The government and its affiliated administrative structures have played important roles in water decision-making processes.

Table 2-1 Summary of the new water paradigm components

Author	Components of the new water paradigm
Serageldin (1995)	1. long-term vision 2. comprehensive management 3. decentralization and stakeholder participation 4. market and price mechanism
Schultz (1998)	1. the principles of sustainable development 2. ecological quality 3. consideration of macro-scale systems and effects 4. planning in view of changes in natural and socioeconomic systems
Gleick (2000)	1. shifting away from seeking new water sources 2. growing emphasis on ecological values 3. re-emphasis on meeting basic water needs 4. use of non-structural alternatives, application of economic principles, and extensive public participation.
WWC (2000)	1. holistic and systemic approach 2. participatory institutional mechanisms 3. full-cost pricing of water services 4. institutional/technological/financial innovations 5. governments as enablers
WCD (2000)	1. gaining public acceptance 2. comprehensive options assessment 3. addressing existing dams 4. sustaining rivers and livelihoods 5. recognizing entitlements and sharing benefits 6. ensuring compliance 7. sharing rivers for peace, development and security

2.3.2. Integrated Water Resources Management (IWRM)

The Rio Conference of 1992 suggested IWRM as a sustainable approach for the international water management that is coined in Chapter 18 of Agenda 21. According to

[5] Various stakeholders can involve actively on water decision-making process.

the Global Water Partnership (GWP), the definition of IWRM 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" (italicized by author) (GWP 2000, 22). The principal idea is to achieve coordinated integration by fulfilling the overriding criteria of *economic* efficiency, *social* equity, and *ecological* sustainability. Three important elements for IWRM to achieve these criteria are the enabling environment, the institutional roles, and the management instruments of an effective water resources management system. The general framework of IWRM consists of these three overriding criteria and three important elements (GWP 2000, 30).

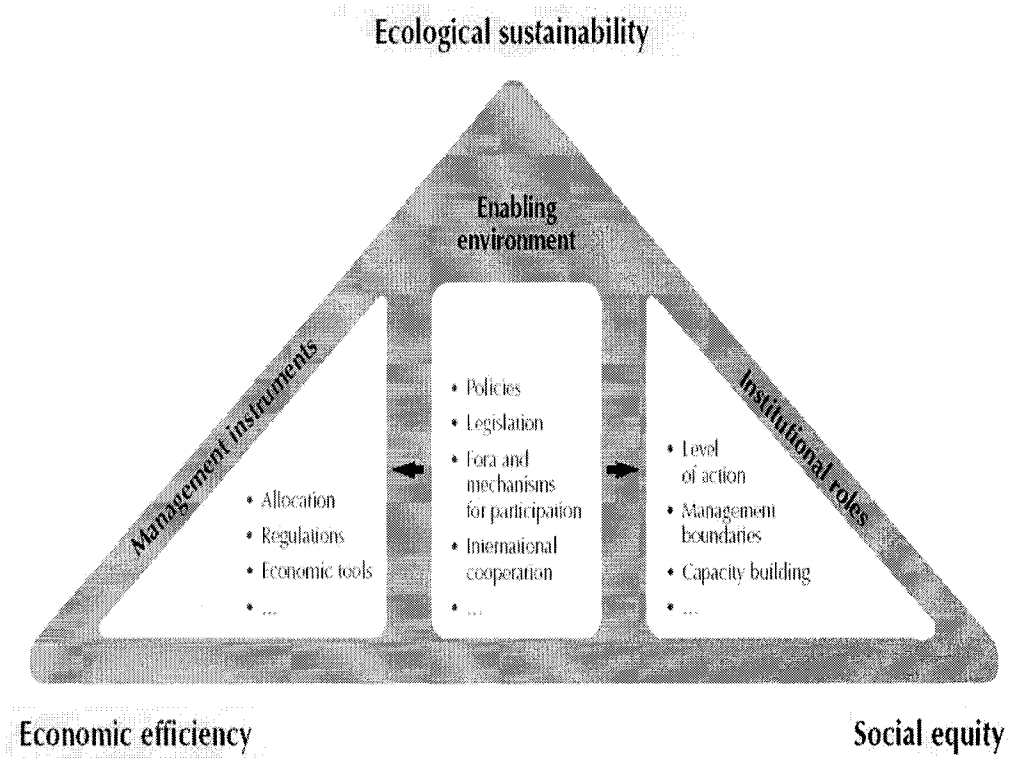

Figure 2-1 The general framework for IWRM (from GWP 2000, 31: Figure 4)

Economic efficiency leads to secure water infrastructure operation and incentives for investment. Social equity is to secure acceptance of necessary trade-offs through stakeholder participation in planning and decision making and to guarantee equitable access to water. Ecological sustainability is to secure ecosystems for both present and future generations (GWP 2000, 30; Falkenmark 2003, 41).

IWRM is designed "to discard with one-sided management perspective of single interests of one sub-sector by one government agency and to strive for a participatory multi-sided management perspective of all interests in management of water resources" (van Hofwegen and Japsers 1999, 7). To achieve such objective, IWA and UNEP proposed 14 principles of IWRM in 2002. These principles, that emerged from several international meetings, are ① catchment level, ② integrated water and environmental management, ③ system approach, ④ full participation, ⑤ social dimension, ⑥ capacity building, ⑦ information ability, ⑧ full-cost pricing, ⑨ enabling environment, ⑩ best practices, ⑪ financing mechanism, ⑫ equitable allocation, ⑬ water as a economic good, ⑭ role of woman (IWA and UNEP 2002, 30-1). These and the other principles are merged into Table 2-2 that follows, to show the international consensus on water management principles.

Table 2-2 International consensus on water management principles

Category	Chapter 18 of Agenda 21 (Rio Conference, 1992)	Strategic priorities (WCD, 2000)	IWRM principles (IWA & UNEP, 2002)
Integration	18.6- Holistic management of freshwater 18.9(a)- Integration of multi-disciplines	Comprehensive options assessment	Integration of water & env't mgt. System approach
Catchment	18.9- Integration at catchment basin level	Sustaining rivers & livelihoods	IWRM at catchment level
Public participation	18.9(c)- Full public participation	Gaining public acceptance Comprehensive options assessment Recognizing entitlements & sharing benefits	Full participation by stakeholders Role of women
Economic good	18.6- Holistic management of freshwater 18.8- Water as social & economic good 18.9(c)- Economically efficient & socially appropriate 18.15- Water as a social & economic good		Water as a economic good Full-cost pricing Reliable & sustained financing
Social good		Recognizing entitlements & sharing benefits Sharing rivers for peace, development, and security	Attention to social dimensions Equitable allocation of water resources
Environmental good	18.6- Holistic management of freshwater	Sustaining rivers & livelihoods	
Planning	18.9(b)- Plan based on community needs 18.16- Water plan in an integrated manner of env/economic/social considerations	Comprehensive options assessment Ensuring compliance	
Capacity building	18.19- Human resources development 18-21- Capacity building		Capacity building
Governance	18.9(d)- Proper institutional/legal/financial mechanism	Ensuring compliance	Role of central government (enabling environment)
Science & Information	18.14- Scientific & technological means of implementation		Information ability
Others	18.17- Demand management mechanism	Addressing existing dams	Adoption of best mgt. practices

2.3.3. Government as enabler

The issue of water governance[6] emerged as an important topic in the international debate on water since the International Conference on Freshwater held in Bonn, Germany in 2001 (Salman 2004, 13). Effective water governance is very important because science and technology are not adequate to achieve a sustainable future without changes in institutions. *The United Nations World Water Development Report* strongly asserts that "the water crisis is essentially a crisis of governance and societies as facing a number of social, economic, and political challenges on how to govern water more effectively" and "sound and effective governance of water resources ··· are paramount to facilitating and supporting an enabling environment" for IWRM (UNESCO 2003a, 370).

It is somewhat hard to pin down a widely accepted definition of the current notion of governance (Meehan 2003). Governance is generally understood as "a way of describing the links between government and its broader environment - political, social, and administrative" while government represents "the portion of the activity that acts with authority and creates formal obligations" (Kettl 2002, 119). Governance is known to arise from lack of government capacity in implementing desired policies, thus it is frequently recognized to represent a contrasting concept of traditional 'command and control' model that implies centralized authority and hierarchical bureaucratic structure (Meehan 2003). The differences between government and governance are summarized in Table 2-3.

The water management trend is transforming from government to governance modes in advanced countries. Lownders and Skelcher identifies that the management trend

[6] The meaning of water governance is still evolving with no agreed definition. UN refers it to "the range of political, social, economic and administrative systems that are in

moved or is moving from hierarchical governance to market governance since the 1980s and, in turn, market governance to network governance since the 1990s (Lownders and Skelcher 1998, 318-9, 330-1). The concept of Lownders and Skelcher in Table 2-4 represents that the hierarchical governance is equivalent to the government mode and the network is to governance mode in Table 2-3.

Table 2-3 Different concepts of government and governance

Item \ Type	Government	Governance
Mode	Statism	Network governance
Role of state	Authority	Enabler
Dominant actors	State actors	State actors + stakeholders
Patterns of interaction	Command and control	Multilateral negotiations

Source: Summarized and revised from Meehan (2003, 4).

The World Bank (1996, 43) argues that when institutions are poor, it bolsters extravagant waste of water resources and inhibits proper investment in the water sector. The internal demands for networked society are increasing as civil society has burgeoned into strong powerful entities. In addition, sustainability requires thinking long-term, but acting now (World Bank 2003, 183). Thus, the issue of effective water governance or government as an enabler is at the core of the new water paradigm.

Water governance should be reorganized to achieve the norm "governments as enablers," one of the five norms (WWC 2000c, vi－vii) as explained in section 2.3.1. The

---

place to develop and manage water resources, and the delivery of water services, at different levels of society" (UNESCO 2003a, 372; Rogers and Hall 2003, 7).

norm requires providing effective and transparent regulatory frameworks for private action as Rhodes conceptualizes "governing without government"[7] (Rhodes 1997, 46-60). Therefore, the water governance is apt to remain inside the policy networks[8] (Borzel 1998, 260).

Table 2-4 Three types of water governance

Item \ Type	Hierarchy	Market	Network
Normative basis	Employment relationship	Contract-property right	Complementary strengths
Means of communication	Routines	Prices	Relational
Methods of conflict resolution	Administrative fiat – supervision	Haggling -resort to courts	Norm of reciprocity – reputational concerns
Degree of flexibility	Low	High	Medium
Amount of commitment among the parties	Medium	Low	High
Tone or climate	Formal, bureaucratic	Precise, suspicious	Open-ended, mutual benefits
Actor preferences or choices	Dependent	Independent	Interdependent

Source: Adapted from Lownders and Skelcher (1998, 319).

Three challenging barriers to be overcome to encourage good institutions for sustainable development are organizing dispersed interests, forging credible

[7] Even though Rhodes' concept is criticized for its little role of a government in the networked society (Davies 2000; Barnett 2003, 2), it is true that the governmental influence on water policy has greatly reduced since the beginning of the 1980s in the United States and since the mid-1980s in the United Kingdom (Bressers et al. 1995).

commitments, and promoting greater inclusiveness (World Bank 2003, 47-50). However, the three challenges are difficult to overcome because of dispersed governmental roles in most countries, fragmented in the United States and divided into five ministries in South Korea as explains in section 6.2.4.

To promote water governance as an enabling environment, every water agency should encourage cooperation (Turton 2000) and coordination (Grigg 1998) with other public entities and private interests. They should embrace the paradigm shift from command and control towards governments as enablers, facilitators, or cooperators with partners (Barnett 2003). The network governance will contribute to realizing dreams of the new paradigm through voluntary, bottom-up, community-led, participatory approaches.

2.3.4. Adaptive capacity for water deficit period

2.3.4.1. Social adaptive capacity

Social adaptive capacity (SAC) is a new concept in the water policy sector as it was developed since the late 1990s by social and political scientists in United Kingdom, Sweden, and South Africa. SAC is social resources[9] to cope with water scarcity and social capacities to manage water stress. If a society meets with a severe drought a social stress will increases for the water shortage and the government will be forced to implement new and more innovative water policies to overcome or adapt to the social problem. It requires mobilization of social resources to conduct the new water policies.

---

[8] Because the government's role for hierarchical coordination becomes decrease and the possibility of market failures increases when a society turns into a complex and dynamic environment.

Thus, the idea is closely related to the new water paradigm, IWRM, and demand-side water management.

The society may embody SAC within institutions or institutional frameworks (Ohlsson 1999, 161; Turton 1999, 8). Mobilizing a new SAC may require structural changes of the existing institutions or creation of new institutional arrangements. The cost of supplying new institutions or transformation of the existing institutions varies substantially according to the surrounding social and political conditions (Ostrom 1990, 140-1).

Homer-Dixon defines two distinct types of ingenuity[10]: technical ingenuity and social ingenuity. The former focuses on the "hard side" of water management with data-intensive approach to solve practical water problems in our "physical world" while the latter deals with the "soft side" of challenges in our "social world." The soft side manages water resources with effective institutional mechanisms of social consensus and government intervention. The two sides are needed to implement effective water policies, but the social ingenuity is a necessary condition for the technical ingenuity (Homer-Dixon 2000, 21-23; Turton 2003, 4). Thus, properly arranged water institutions[11] improve technical and social capacities of a society because success in institutions enables to generate social capital that enhances institutional capacity (Ostrom 1990, 190).

Karshenas suggests a relationship between economic growth (in the form of standard of living) and environmental protection (in the form of environmental resources stock). His opinion shows that environmental protection measures of a society may result in a

---

[9] At least two forms of social resources are available: the ability to develop alternative policy options and the ability to mobilize social consensus to legitimate these options into executable government policies (Turton 1999, 36).

[10] Ingenuity is "ideas that can be used to solve practical technical and social problems, such as the problems that arise from water" (Homer-Dixon 2000, 21).

short-term economic stagnation and a long-term improvement of living quality. But, without such measures, the society may eventually incur economic collapse as a result of environmental degradation. The environmental protection measures generally consist of three types of governmental programs: preventive[12], corrective[13], and adaptive[14] (Karshenas 1994, 743-6).

Ohlsson (1999) classifies water scarcity into two dimensions: first-order water scarcity[15] and second-order water scarcity[16]. He develops a theoretical model by connecting water scarcity with SAC. He recognizes SAC of a society as a social resource to understand the social dynamics of water scarcity (Turton 1999). Turton (1999) combined the concepts of the first-order water scarcity (Karshenas' theory) and the second-order water scarcity (Ohlsson's theory) to understand the transforming relationship from the supply-side water management (SWM) to the demand-side water management (DWM) which is implemented to overcome increasing water scarcities.

Ohlsson maintains that the new water policy should depend on not technical and engineering approaches but the social and political processes to manage water deficit and to lead proper water policy reform (Ohlsson 1999, 193; Allan 2001, 325). The technical and engineering approaches can not compensate for the second-order water scarcity or

---

[11] Water institutions consist of three broad sub-sectors: water law, water policy, and water administration (Saleth and Dinar 1999, 4-5).

[12] It is ex ante measures that generally require the polluter pays principle to reduce source pollutant discharges.

[13] It is ex post measures that conduct cleaning-up activities on polluted resources.

[14] It converts the economy to cope with the adverse effects of environmental pollution.

[15] It is "the physical shortage of water" (Allan 2001, 323) or the existence of water scarcity (Turton 1999, 8). This concept first came from the theory of Karshenas (1994) and later was extended to denote physical water scarcity by Allan and Karshenas (1996), Turton (1999), and Ohlsson (1999).

the lack of SAC. Only sufficient SAC can cope with the first-order water scarcity or the water shortage problem. An economy with enough SAC can resolve the physical water scarcity (Allan 2001, 323). If the society can mobilize proper SAC against the water scarcity, it may overcome the water scarcity and move to the state of sustainable development. The degree of the new water policy relies on the existing level of SAC within the society at that time (Turton 1999, 10-1).

2.3.4.2. Demand-side water management

The thrust for SAC in a society emerges from the starting point of water scarcity and becomes urgent with transition to water deficit as depicted in Figure 2-2. When the society meets with a water deficit, it is forced to learn, for the first time, ways of living with water deficit by technical and economic methods of saving water and later by finding social methods of SAC. The first-order water scarcity begins to emerge with the increased level of water scarcity, water managers usually turn to engineering and technical means or supply-side water management to deliver more water (Ohlsson 1999, 148). This pattern prevailed during the period of hydraulic mission[17] in the United States until the 1960s (see section 3.5 and Table 3-5) and the period of multi-purpose dam construction in South Korea until the 1980s (see section 3.5 and Table 3-6).

---

[16] It is "lack of capacity to ameliorate the shortage" (Allan 2001, 323). Ohlsson (1999) suggests the concept to denote the relationship between water scarcity and adaptive capacity. He refers to it as lack of social adaptive capacity.

[17] Hydraulic mission is an overarching rationale to develop water resources under development vision and politics. It was first and fully implemented in the United States and became the global perspective during the first half of the 20th century (Allan 2001, 28). Turton (1999) reviews the American hydraulic mission. Reisner (1993) criticizes water development practices in the Western U.S. in his famous book *Cadillac Desert*.

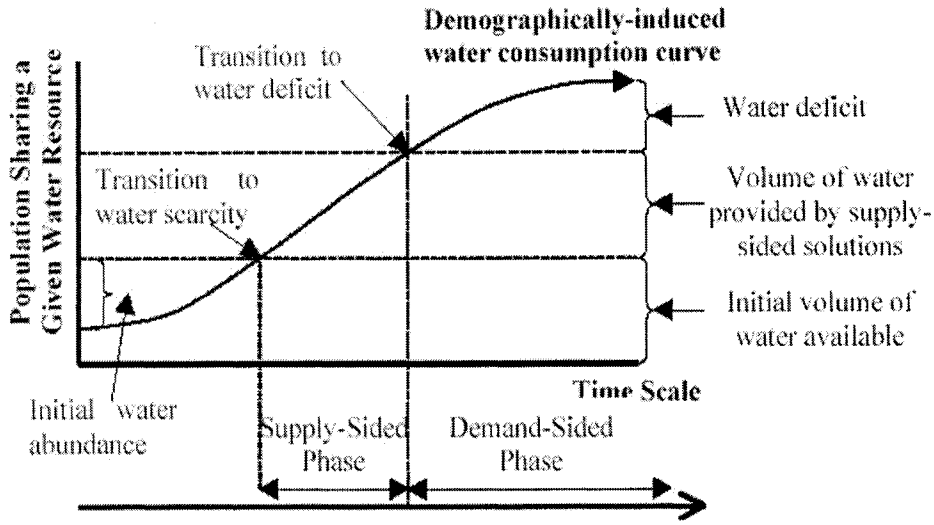

Figure 2-2 Transition of water management from supply-side to demand-side[18]

The sufficient SAC enables the society to trigger a paradigm shift from SWM to DWM. DWM is generally caused by the increased cost of SWM (see section 6.2.2.1 and Table 6-1) and by the changed public attitudes towards environmental conservation (see section 5.2.4). In this stage, the direction of the existing water policy – SWM based on the old water paradigm - is being questioned by the environmentalists in form of environmental movement (Turton and Ohlsson 1999, 6) or by international organizations like the World Bank (1993), the World Commission on Dams (2000) and Pitman (2002)[19].

The DWM phase initially emerges as form of end-user efficiency[20] and later as from of allocative efficiency[21]. The society is forced to adopt allocative water policy when water

[18] From Turton and Ohlsson (1999, 5: Figure 3); Permission from the author.

[19] Pitman published a strategic report of the World Bank in the title of *Bridging troubled waters: assessing the World Bank water resources strategy.*

[20] End-use efficiency is used to improve the water delivery efficiency or to reduce end-use water demand. The main policy tool for the end-use efficiency is economic incentives to put the right price on water (Ohlsson 1999, 181).

deficit exceeds the sustainability level in Figure 2-3, but this approach entails a high social stress to be one of the least selected policy alternatives by elected water managers or politicians. With successful implementation of DWM, the society finally adapts to the water deficit condition and thereafter the water demand of the society begins to decrease until below or at the sustainability level. The water policy to implement the end-use efficiency is technically and politically easy alternative while the allocative efficiency is technically and economically relatively simple but socially and politically extremely complex (Turton 1999, 22-3).

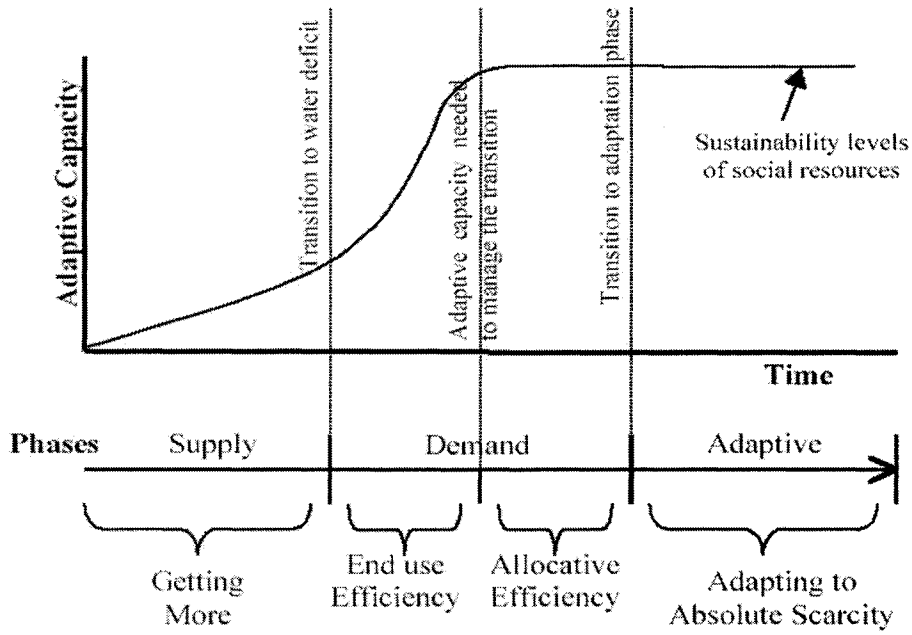

Figure 2-3 Social adaptive capacity with different water management phases[22]

[21] Allocative efficiency can be achieved by allocating water away from lower water efficiency to higher water efficiency(Ohlsson 1999, 181). Water transfer or water bank are practical approaches moving water from agricultural to urban uses.

[22] Adapted from Turton and Ohlsson (1999, 14: Figure 6); Permission from the author.

The policy goal for dealing with water scarcity stems from equitable distribution of competing water demands during the period of SWM. Then, it changes to facilitate technological innovations and economic incentives to get more efficient end-use water saving during the period of end-use efficiency. Finally, social and political considerations are necessary to achieve greater allocative efficiency by way of market mechanism and government intervention (Ohlsson 1999, 189-90).

These considerations enable the recognition of the new paradigm thrusts and the adoption of politically costly DWM that leads to the stage of IWRM or sustainability. The DWM will transform "a process of forced environmental degradation" (Karshenas 1994, 752) or "phase of resource run-down" (Turton 1999) into "phase of resource reconstruction" (ibid.). Therefore the need for SAC is evident as SAC will lead the stock of water resources to be replenished (Karshenas 1994, 752; Allan and Karshenas 1996, 126; Turton 1999).

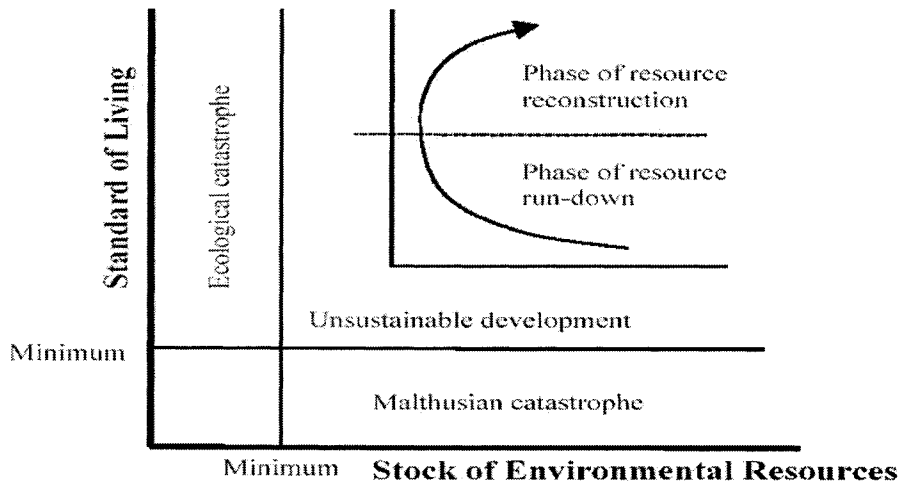

Figure 2-4 Normal pattern of demand-side water management[23]

[23] Adapted from Turton (1999, 3: Figure 1c); Permission from the author.

Turton and Ohlsson (1999) conceptualize an interconnection between adaptive capacity and natural resource management by focusing on two components of adaptive capacity. The structural component of adaptive capacity can be represented by capacity-building to generate the demand-side water management strategies by water agencies. The social component consists of the willingness and ability of a society to accept the strategies as reasonable and legitimate policy alternatives (Turton 2000, 19). However, adaptive capacity alone is not enough for formulating and implementing the strategies effectively without cooperation (ibid. 20) and coordination (Grigg 1998) between stakeholder interests. South Korea will face challenges in the future to provide these within the framework of its water governance.

2.4. Past international efforts towards the new paradigm

2.4.1. From control to accommodation

McCormack (2002) explains the competing water paradigms in the United States and how they were transformed from the paradigm of the 20th century where the river was viewed with a combination of functions like water supply, flood control, hydropower, etc. This supply-side management pursued the maximum material benefits of water resources. The new paradigm prefers accommodation with nature rather than to control it.

These changing perspectives were addressed in international conferences since the 1970s. The old water paradigm, including securing clean water, was displaced with sustainable development since the mid-1980s and IWRM since the 1990s. The leading water issues can be classified as Clean Water (1970s), Sustainable Development (1980s),

Global Water (1990s), and Water Security (2000s) in Figure 2-5. In addition, major international conferences that dealt with water issues are summarized in Table 2-5.

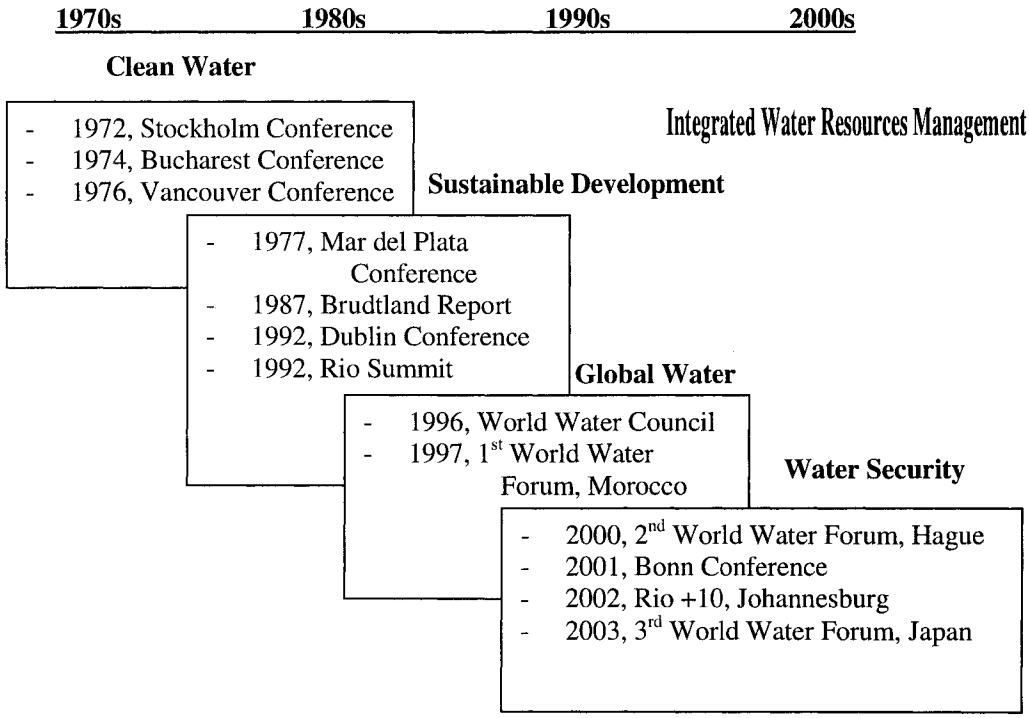

Figure 2-5 Leading water trends discussed in international conferences

2.4.2. Water supply and water quality

A new thinking of water resource management stemmed from the Stockholm Conference and the Mar del Plata Conference in the 1970s. Water supply and sanitation were important issues then, and until the mid-1980s conferences focused on the narrow problem of water supply, wastewater treatment, and food production. To supply clean and enough water for city, irrigation and industry were focus areas in the 1970s. These water quantity issues gave way to water quality when environmental degradation and pollution attracted the attention of the international community.

Table 2-5 Major international conferences on water

Year	Conference name	Important results or recommendations
1972	UN Conference on Human and Environment (Stockholm, Sweden)	First world conference by the UN World attention to growth and environment Emergence of UNEP
1977	UN Conference on Water (Mar del Plata, Argentina)	First UN conference on water Major role of water management Land and water as an integrated unit
1990	Global Consultation on Safe Water and Sanitation for the 1990s (New Delhi, India)	New Delhi 4 principles Suggest integrated approach
1991	Informal Consultation on IWRM (Copenhagen, Denmark)	Preparatory meeting for 1992 UNCED Discuss demand approach
1992	UNDP Symposium on Water Sector Capacity Building (Delft, The Netherlands)	Preparatory meeting for 1992 UNCED Discuss the concept of capacity building
1992	Int'l Conference on Water & Environment (Dublin, Ireland)	Dublin 4 principles
1992	UN Conference on Environment and Development (Earth Summit) (Rio de Janeiro, Brazil)	World summit meeting Chapter 18 of Agenda 21 Emergence of UNCSD
1994	UN Commission on Sustainable Development (2^{nd} meeting)	Support of Rio principles
1997	The First World Water Forum (Marrakech, Morocco)	Initiate World Water Vision
1997	UN General Assembly (19^{th} Special Session)	Support of Rio principles
1998	UN Commission on Sustainable Development (6^{th} meeting)	Support of Rio principles
1998	International Conference on Water and Sustainable Development (Paris, France)	Programme for Priority Action
2000	The Second World Water Forum and Ministerial Conference (The Hague, The Netherlands)	Publish World Water Vision Initiate Framework for Action World Water Assessment Programme
2000	UN General Assembly Millennium Declaration	Stress the importance of water Set 2015 world water goal
2001	International Conference on Freshwater (Bonn, Germany)	Preparatory meeting for the Rio+10 of 2002 The issue of water governance emerges
2002	World Summit on Sustainable Development (Johannesburg, South Africa)	Rio+10 summit meeting Check the result of Agenda 21
2003	The Third World Water Forum (Kyoto, Japan)	Publish Framework for Action Publish World Water Development Report

The United Nations Conference on the Human Environment (UNCHE)[24] of 1972, the first international conference under the aegis of the United Nations (UN), led to formation of the UN Environmental Programme (UNEP) to deal with global environmental issues[25]. The UN Conference on Water[26] of 1977 dealt with water supply and sanitation (Savenije 2001, 13). In response, the UN declared the International Drinking Water Supplies and Sanitation Decade for the 1980s with the slogan of 'Water and Sanitation for All.' It did not fulfill its objective with even the extended period until 2000[27] (EC 1998, 23-24).

2.4.3. Sustainable development in the 1980s

When securing water for current and future generations became a priority in the 1980s, the World Commission on Environment and Development (WCED) suggested the concept of "sustainable development" by publishing *Our Common World*, known as the Brundtland Report. The classic and widely-used definition of sustainable development is "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, 9).

Although the idea looks simple, the applications to water management are confusing and need substantial tasks. The two cores of sustainable development are inter-generational equity (Gardiner and Perala-Gardiner 2000, 346; Loucks and Gladwell 1999,

[24] It was held in Stockholm, Sweden from June 5th to 16th, 1972; http://www.unep.org/Documents/Default.asp?DocumentID=97.

[25] http://www.interchg.ubc.ca/dorcey/principles/G1/Bahman-Yvette.htm.

[26] It was held in Mar del Plata, Argentina from March 14th to 25th, 1977. It is considered the first water-oriented international conference in the world.

29) and holistic characteristics encompassing inter-sectoral cooperation. They suggest that a society living with healthy natural systems can be attained with interdisciplinary approaches of inter-sectoral understanding and inter-generational sustainability.

2.4.4. Integrated Water Resources Management in the 1990s

The 1990s saw the era of IWRM, a concept from the International Conference on Water and Environment (ICWE) and the United Nations Conference on Environment and Development (UNCED) in 1992[28]. Its development has been accelerated by international consensus that a more integrated approach to water resource management is needed. The philosophy of effective water resources management has changed in the last 30 years from local, simple, and separated framework to one that is global, complex, and holistic. The IWRM principles are discussed in section 2.3.2.

2.4.5. World Water Forums in the 21st century

The First World Water Forum[29] discussed a global water strategy for growing concerns, and participants asked the World Water Council (WWC) to conduct a three-year global assessment for freshwater resources. WWC developed the Long-term Vision for Water, Life, and Environment in the 21st Century, or World Water Vision (WWV) for short.

---

[27] It entered into the second Decade with the similar slogan of 'Water and Sanitation for All by the Year 2000' because its previous goal of improving the public health by the expansion of service coverage found to be unsuccessful.

[28] The concept of IWRM did not widely discuss until 1991 when the Copenhagen Informal Consultation on Integrated Water Resources Development and Management adopted it as a topic. The demand driven approach and the subsidiarity principles were discussed in the meeting (Savenije 2001, 13).

[29] It was held in Marrakech, Morocco in March 20th to 23rd 1997 with sponsorship of the World Water Council.

WWC realized that sharing a long-term vision among world communities is the first step to address the world water crisis (WWC 2000c, iv, x ii). WWC established two bodies to conduct the activities of WWV: the Vision Management Unit[30] and the World Commission on Water for the 21st Century to provide the overall direction of WWV exercises[31].

The Second World Water Forum and the Ministerial Conference[32] were held from March 17th to 22nd 2000, in The Hague. At the forum, the global water crisis was identified and strategies to ensure clean and sufficient freshwater in the future were discussed. Privatization of water and water as a basic human right were hot topics at the forum and in the press (WWC 2000b, 5). The Ministerial Conference[33] was held during the last two days of the forum. The Ministerial Declaration on Water Security in the 21st Century identified seven global challenges (WWAP 2001, 4-5).

The Third World Water Forum[34] of 2003 was convened to deal with key issues of safe and clean water for all, governance, capacity building, financing, participation, and regional issues. A milestone report *The United Nations World Water Development Report* (WWDR)[35] was released in the forum. The WWDR refers to the world's water crisis as an output of water mismanagement that is a form of bad water governance (UNESCO 2003b, 4-7). However, the Third World Water Forum led to few agreements on world

---

[30] It guides the day-to-day development of WWV.

[31] WWV moves us from where we are today to where we need to be to meet future water needs by assessing the world water situation from the global perspective; http://www.iwrn.net/d3pages/Visonppr.pdf.

[32] http://www.worldwaterforum.net/index2.html.

[33] It was sponsored by the government of The Netherlands for successful meeting.

[34] It was held during March 16th to 23rd 2003, in Kyoto, Osaka and Shiga of Japan with over 24,000 participants from all of the world; http://www.world.water-forum3.com.

water issues. Thus it is considered to be limited in success, given its large attendance and publicity.

2.4.6. Water Framework Directive: a new paradigm in Europe

The Water Framework Directive (WFD) was first conceived at the Community Water Policy Ministerial Seminar held in Frankfurt, Germany in 1988, in which the European Commission was requested to "submit to improve the ecological quality of Community surface waters" (EU 2000a, 2). EU initially decided to present a proposal for the WFD in 1997 after a ten-year conciliation period, finally reached a final agreement on the proposed WFD on 30 June 2000 after very difficult negotiations for three and a half years between the Council and the European Parliament (Kallis and Butler 2001, 1).

On 23 October 2000, EU finally adopted an innovative water policy initiative, the "Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy," (EU 2000b) generally referred to as the WFD. The WFD entered into force on 22 December 2000 when the official text of WFD was published in the *Official Journal of the European Communities* (Official Journal L 327, 22.12.2000). It was amended by the "Decision No 2455/2001/EC of the European Parliament and the Council of 20 November 2001" (Official Journal L 331, 15.12.2001)[36].

The emergence of WFD implies the ending of a long conflict between the principle of regional subsidiarity of the EU member states and the principle of environmental

---

[35] It is the first WWDR that was initiated by the World Water Assessment Programme with cooperation of 23 UN agencies.

[36] http://europa.eu.int/scadplus/printversion/en/lvb/l28002b.htm.

consistency at the European level, and the beginning of a new era in EU environmental policy into 21st century. The WFD is intended to ambitiously protect aquatic ecological environment and improve aquatic ecological status by transforming EU's water from protection of particular waters of local interest to protection of entire natural ecosystem of each river basin. It also emphasizes the integration of social, economic, and ecological aspects of water, which leads to a fundamental reorganization of water management systems of European countries into each river basin boundary (Olsen 2002, 2).

According to Olsen (2002, 3-4), WFD will accomplish its main objectives set for 2015 with minimum requirements through the following structures:

① Creating an overall framework within the Community, national, regional, and local authorities and the social partners may develop integrated and coherent water management.
② The Water Framework is the conceptual and procedural framework within which all existing water legislation must be coordinated and compiled with.
③ Good ecological status of aquatic ecosystems is defined in a way that takes into account the natural climate and ecological conditions as these vary across the Community.
④ Requiring transparency through publication and dissemination of information and through public consultation.
⑤ Establishing a sound basis for collecting and analyzing a large amount of information on the aquatic environment and the pressures upon it.

2.5. New water paradigm towards reflexive modernity

Beck (1992) elaborates the idea of reflexive modernization in his famous book *Risk society: Towards a new modernity* to denote the broad current of social change affecting Western societies (Aiken 2000, 3). He suggests three distinct societies from traditional era to post-modern era: pre-modernity[37], simple modernity[38], and reflexive modernity[39]

[37] It is a traditional society before industrial development.

(Beck 1992, 3). The reflexive modernity requires "the re-construction of prior theory and the re-evaluation of prior fact" (Kuhn 1970, 7) that were accumulated during the simple modernity. Therefore, the reflexive modernity means the new paradigm that is different from the old modernity because the former is a "very different thing" from the latter (Sharrock and Read 2002, 31).

Reflexivity emerges when a society becomes aware of the undesirable and unintended consequences as a result of its development actions (Turton 2000, 2). Redefining the Beck's idea in terms of water management, the simple modernity (water development paradigm) was supplanted by the reflexive modernity (water protection paradigm) by environmental movements during 1960s and 1970s in the Western society. The water management practices in the reflexive modernity require the same components of the new water paradigm discussed in sections 2.3.1 and 2.3.2.

Millar (2002) and Brouma (2003) mention five water management paradigms inspired by two theories from the reflexive modernity of Beck (1992) and the social adaptive capacity (see section 2.3.4) of Turton (1999): pre-modernity[40], industrial modernity[41], green reflexive[42], economic reflexive[43], and political and institutional reflexive[44]. Most

---

[38] This period is characterized by industrial and capitalist society with rapid advancement of science and technology (Aiken 2000, 4).

[39] This period is on the extended line of simple modernity (industrial society), but very different from the old society through a change. It faces with problems resulting from side effects of the old techno-economic society (Aiken 2000, 4).

[40] The first water paradigm denotes initial water abundant paradigm during the pre-modern society which has limited social adaptive capacity and technical expertise (Brouma 2003). It enjoys water abundant condition before the supply-sided phase in Figure 2-2.

[41] The second paradigm implies the hydraulic mission during the industrial society. It is in the supply-sided phase in Figure 2-2. The mission ignited the environmental movement since the 1960s which led to reconsider the value of water (Brouma 2003).

[42] The third paradigm comes with recognition of limited and environmental values of water. It is in the end-use efficiency phase in Figure 2-3.

countries in the South still remain in the industrial modernity paradigm which supports the hydraulic mission to supply more water for their peoples. Many countries in the North moved to the stages of the third paradigm (green reflexive) or the fourth paradigm (economic reflexive) since the 1970s.

Table 2-6 Five paradigms of water management and their characteristics

Pre-modernity	Industrial modernity	Green reflexive	Economic reflexive	Political reflexive
Free good	Water as a resource	Environmental good	Economic & social goods	Scarce & political goods
Certain		Uncertain		
Laissez-faire	Supply mgt.	Demand management		Adaptive mgt.
Enough water	Getting more water	End use efficiency	Allocative efficiency	Adapting to water scarcity
Less gov't action	Hydraulic mission	Reflexive response	Partial IWRM	Full IWRM
Less conflict	Intergovernmental process	Env'tal process	Economic & Social process	Political & institutional
Small reservoir	Large dam building	Social awareness & env'tal movement	Partial & full Sustainable development	
	Egypt, Iran	South Korea	USA, UK, Israel	

United Kingdom and Israel are good examples in advancing to the fourth paradigm stage (Allan 2001, 325-7; Brouma 2003). South Korea has been experiencing the green

[43] The fourth paradigm is inspired by economists who brought 'water as an economic good' concept in the water sector. It requires economic instruments to recover the full cost of water. It lies between the end-use efficiency and the allocative efficiency, but more in the allocative efficiency phase in Figure 2-3.

reflexive paradigm since the late 1990s, especially during the Youngwol conflict (see chapter 4). Now, South Korea is moving towards the economic reflexive paradigm since the turn of the 2000s when it began to implement various economic instruments (see section 6.2.2). Table 2-6 shows the five water paradigms and their characteristics.

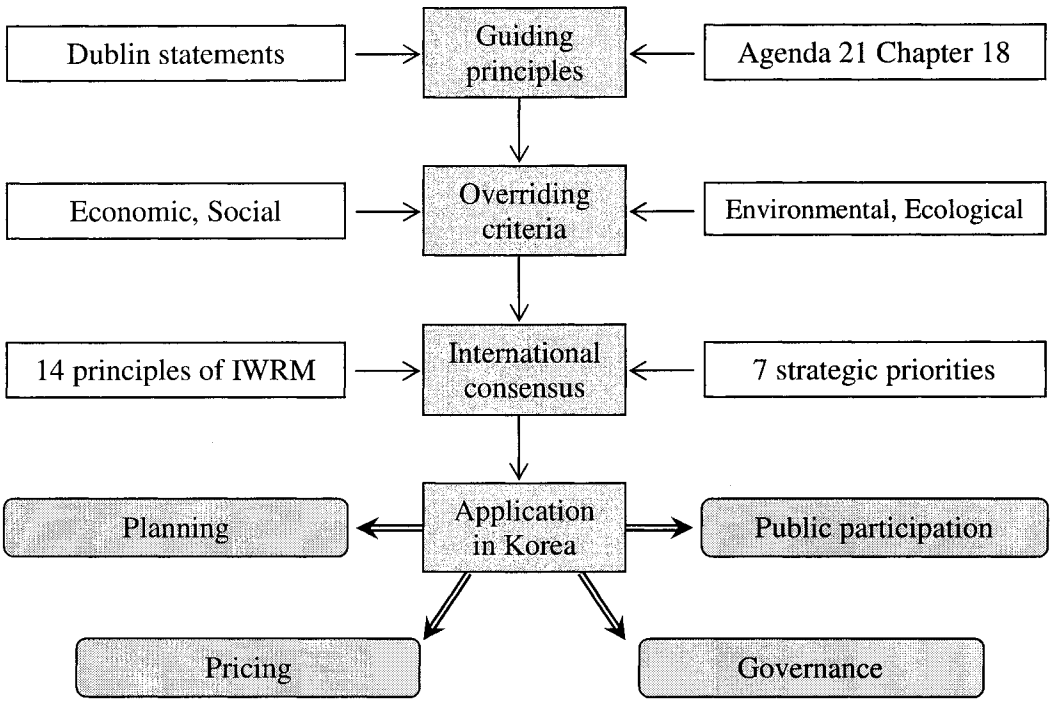

Figure 2-6 From international ideas to national actions of South Korea

2.6. IWRM components in South Korea

As explained in section 2.3.2, a number of the IWRM components in Chapter 18 of Agenda 21 have converged into 14 principles. Most of the 14 principles apply in any

[44] The fifth paradigm begins when a society recognizes 'water as social and political goods' concept (Millar 2002). The IWRM principles (see section 2.3.2) are fully applied

country including South Korea, and they have been focused into four main elements that are considered the principal components in South Korea as depicted in Figure 2-6. These are planning, pricing, public participation and water governance. The application of the four major elements in South Korea will be explained in detail in chapter 6. Table 2-7 explains why these four elements are most important in South Korea.

Table 2-7 Four main elements of IWRM in South Korea

Element	14 principles	Why important in South Korea?
Planning	② integrated water and environmental management ③ system approach	◦ Korea has government-led national planning mechanisms (section 6.2.1). ◦ They become open, transparent & time-consuming process (section 6.2.1).
Pricing	⑧ full-cost pricing ⑪ financing mechanism ⑬ water as a economic good	◦ DWM is introduced in South Korea (section 6.2.2). ◦ Pricing policy is applied to induce water conservation (section 6.2.2).
Public participation	④ full participation ⑤ social dimension ⑩ best practices ⑭ role of woman	◦ Public acceptance becomes the principal tenet of water project (section 6.2.3). ◦ Policy process becomes so complicated from extensive involvement of the public & civil society (section 6.2.3).
Water governance	① catchment level ⑥ capacity building ⑦ information ability ⑨ enabling environment ⑫ equitable allocation	◦ World's water crisis is one of water governance (UNESCO 2003b, 4). ◦ Water governance becomes the most salient water issue (MOCT 2003, 25-27; Choi &Choi 2002; section 6.2.4).

in managing water resources. It is in the adaptive phase in Figure 2-3.

2.7. Concluding remarks

The widely recognized water paradigm embraces the five important norms and the 14 IWRM principles as shown by a series of international conferences. The international ideas are reduced to select the four principal IWRM elements in this chapter that are essential to understand the new water paradigm in South Korea.

The international consensus on the IWRM principles in Table 2-2 and the four elements of IWRM for South Korea in Table 2-7 are nothing more than water policy guidelines to balance demand and supply of water through social consensus process. It requests society to achieve sustainable development in the water sector through reconsidering the values of water and introducing demand-side water management. Sustainable development suggests "a switch in emphasis from supply management to demand management" (Morris 1998, 230) and demand management means "a policy for the water sector that stresses making better use of existing supplies, rather than developing new ones" (Winpenny 1998, 297).

With the international understanding of the new water paradigm in this chapter, the water management practices of South Korea and the United States will be discussed in the next two chapters, at the national level in chapter 3 and at the local level in chapter 4. The driving forces present in South Korea will be discussed in chapter 5. These lead to a presentation in chapter 6 of how the new paradigm will work in South Korea. Chapter 6 will discuss the demand-side water management practices implementing in South Korea to achieve the new water paradigm, sustainable development and IWRM.

3. Water policy in South Korea and the United States: A comparison

3.1. Purpose of chapter

Since the World War II, South Korea and the United States have developed a close relationship and American experiences have influenced South Korea, especially since the 1960s when South Korea began to emphasize water resource development for economic development. To set the stage for analyzing water policy developments in South Korea, its emerging water policy is compared in this chapter with that of the United States.

The United States has analyzed its water policy continually. Viessman wrote that it needs the new paradigm to address water problems by adopting more aggressive and innovative water policies including institutional modernization and integration of water and land management policies (Viessman 1998, 4). In a similar way, South Korea should review its water policies to adapt them to changing environments. The two countries face similar needs, where new and more holistic thrusts are needed, including capacity–building. So, while the nations are different, they face many similar issues.

The chapter will review water policies at federal and state levels, their impacts on water resources management, and processes to plan water resources projects in the two countries. Two levels of comparative analyses are included: the national levels for South Korea and the United States, and how South Korea compares to the state-level water management for two states, California and Colorado. New thinking in the American water policy transforming from development to management and their lessons for South Korea will also be discussed.

3.2. South Korea vs. the United States

3.2.1. General characteristics

While South Korea is small (only 1.03% of the United States), it is the fourth densest country in the world. South Korea has more annual rainfall (1,283 mm) and less per capita per day renewable water resources (1,491 m^3) than those of the United States (760 mm and 7,407 m^3). These unfavorable conditions lead South Korea to the water stress group[45].

The economic size and national budget of South Korea are about 4.4% – 4.7% of those in the United States. Considering its small land size and economic condition, South Korea invests relatively more government funds into the water resource and pollution control sectors than the United States (6.8% versus 0.7%). This gives South Korea's central government more influence, whereas in the United States the federal government has become more of a regulator than an enabler. In the United States, state and local governments have more influence in many ways.

South Korea has a unitary and central government system, while the United States has a federal system with 50 independent states. Government employment is quite different, as the Ministry of Environment of South Korea has 1,303 full-time employees while the United States EPA employs 18, 095 full-time staffs, and when state EPA staffs are added, the total would be much greater.

---

[45] It is based on the water stress index of water scarcity to understand the effect of population change on per capita water supply. The index classifies four groups based on m^3 per capita per day: no stress (above 1,700), stress (1,700-1,000), scarcity (1,000-700), absolute scarcity (below 500) (UNESCO 2003a, 70-4).

Table 3-1 General comparison between South Korea and the United States

Item \ Country		South Korea (A)	United States (B)	% (A/B)	References
Total land size (㎢)		99,585	9,631,418	1.03	STAT-Korea[46] USCB (2002)
Water area (㎢) (% of land size)		2,804 (2.8%)	469,495 (4.9%)	0.60	KRIHS[47] USCB (2002)
Population (thousand persons)		47,904	278,059	17.2	USCB (2002)
Population density (persons/㎢) (Mainland except Hawaii & Alaska)		481	29 (36)	6% (B/A)	UNESCO (2003a)
Political system (Hierarchical structure)		Central (C-P-L)	Federal (F-S-L)		
Renewable water	Total (㎥/year)	69.7	2,071	3.5	UNESCO (2003a, 72)
	Per capita (㎥/person/year)	1,491	7,407	20.1	
GDP ($ billion) (as of 2000)		457	9,810	4.7	USCB (2002)
Per capita income (current dollars)		$10,013 (2002)	$35,704	24.9	MPB (2003) USCB (2002)
Central/federal gov't budget ($ billion) (% of total)	Total	82.7	1,863.9	4.4	MPB (2003) CPQSFR (2002b, 279) USCB (2002)
	Water resources	2.9 (3.5%)	5.4 (0.29%)	53.7	
	Water quality	2.7 (3.3%)	7.7 (0.41%)	35.1	
# of government employees (% of population)	Total	889,964 (1.9%)	20,572,000 (7.5%)	4.3 (25.3)	MOGH (2002)
	Central/federal	394,738	1,629,800	24.2	OECD (2002)
# of employees in department (Agency name)	Water policy coordination	22 (CPQSFR)	0 (WRC)	-	CPQSFR (2002a)
	Development	3,401 (MOCT)	139,539 (DOI+DOT)	2.4	OECD (2002)
	Environment	1,303 (MOE)	18,095 (EPA)	7.2	

1. Most data are as of 2001 except specified.
2. C-P-L: Central – Provincial – Local, F-S-L: Federal – State – Local
3. WRC exists in the government structure, but the agency function became extinct in 1981.

[46] The Korean Statistical Data Base System that is operated by the Korea National Statistical Office at http://www.stat.go.kr/statcms/main.jsp.

[47] The Korea Research Institute for Human Settlements at http://sun.krihs.re.kr:8888.

3.2.2. Large dam construction

In the United States, the federal system dominates dam construction. In South Korea, seven national statutes[48] are involved in constructing a large dam or a multi-purpose dam. This process is clearer than in the United States, where many state and local obstacles, as well as potential legal challenges confront the dam planner.

In South Korea, the policy process consists of five major steps from project planning to dam construction as in Figure 3-1. The Ministry of Construction and Transportation (MOCT) has played an important role as the leading governmental ministry. The Korea Water Resources Corporation (KOWACO) is the executive operation body for multi-purpose dams and water supply dams.

In the United States, the Corps of Engineers (COE)[49] has been a leading national agency in building large dams, and the Bureau of Reclamation has built many dams in the West. The Water Resources Development Acts and the Reclamation Act are major federal statutes concerning large dam construction in the United States. Now, the National Environmental Policy Act (NEPA)[50] and the Clean Water Act (CWA)[51] have become more decisive factors in planning dam projects.

---

[48] They are Act on Construction of Dams and Assistance, etc. to their Environs (Dam Act); Act on Assessment of Impacts of Works on Environment, Traffic, Disasters, etc. (EIS Act); Korea Water Resources Corporation Act (KOWACO Act); Construction Technology Management Act (CTMA); Special Act on the Safety Control of Installations (SASCI); Act on Litigation to Which the State is a Party (ALWSP); and Act on Special Cases concerning the Acquisition of Lands for Public Use and the Compensation for Their Loss (ASCAC). In addition, Account Regulation on the Management of Government-Invested Institutions (ARMGI) and Enforcement Decree of the Construction Technology Management Act (EDCTMA) are also needed to construct large dams.

[49] Its duty is to develop, manage, and protect the Nation's water resources through complying with the laws and policies prepared by the Congress and the Administration.

[50] NEPA is the basic national charter for protection of the environment by establishing policy, setting goals and providing means to carry out national policies (Section 101(a)).

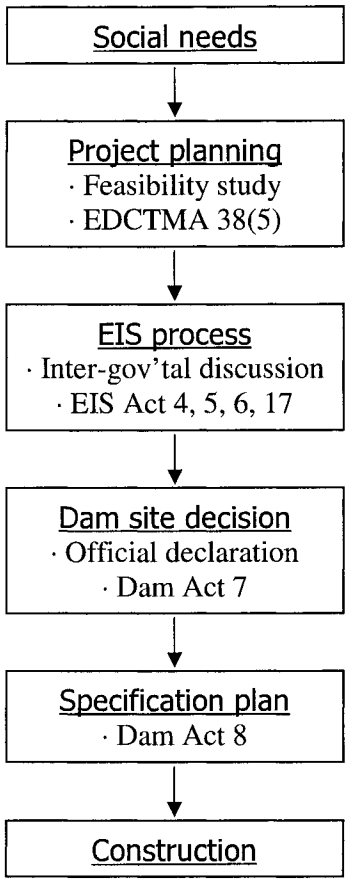

Figure 3-1 Policy process of dam construction in South Korea

Other statutes are involved as well, and to plan water projects in the United States, agencies must fulfill requirements of NEPA and the other statutes through conducting extensive environmental studies[52] that show alternative solutions and positive and negative impacts of dam construction (COE 1999, '3-2'). The federal environmental

[51] CWA defines the basic structure for regulating discharges of pollutants into the waters of the United States. Discharging any pollutant into navigable waters without obtaining a permit under CWA provisions is unlawful.

[52] The proposal should be examined by extensive assessment of all relevant of structural and nonstructural alternatives means through different choice criteria to ensure an unbiased analysis of both COE and non-COE means of resolving water and related land use problems.

agency EPA has emerged as an important agency[53] because of its authority to oversee the permitting right of COE under Section 404(c)[54] of CWA.

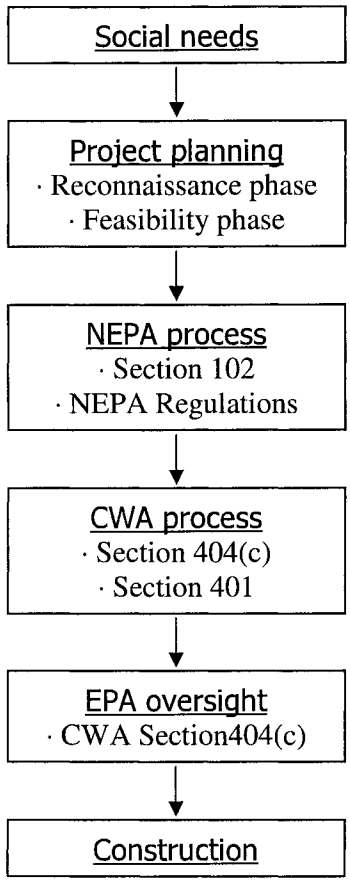

Figure 3-2 Policy process of dam construction in the U.S.

[53] CWA gives EPA the authority to implement pollution control programs. To comply with the CWA requirements, COE should obtain a 404 permit by the Section 404 of CWA and a State Water Quality Certification before the initiation of project construction.

[54] "··· to deny or restrict the use of any defined area for specification ··· as a disposal site, whenever he determines ··· that the discharge of such materials into such area will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas."

3.2.3. Public involvement

The engineering perspective was nearly the unique factor in building large dams before the Second World War in the United States and until the 1970s in South Korea. The role of economists became important during the 1930s in the United States and since the 1980s in South Korea. Benefit-cost analysis (BCA) has been widely applied in the both countries, but BCA has sometimes been abused to justify political decisions of water projects (Feldman 1991, 6, 160).

Table 3-2 Major policy actors in water resources development

Period	United States	South Korea
Until 1960s	Engineers, economists	*Engineers*
1970s	Engineers, economists + *Environmentalists*	
1980s	Engineers, economists, environmentalists + *Sociologists*	Engineers + *Economists*
Early 1990s	Engineers, economists, environmentalists, sociologists + *Affected people*	Engineers, economists + *Environmentalists*
Mid 1990s	Engineers, economists, environmentalists, sociologists, affected people + *NGOs*	Engineers, economists, environmentalist + *Affected people*
Late 1990s		engineers, environmentalists, economists, affected people + *NGOs* + *Sociologists*
Early 2000s	Engineers, economists, environmentalists, sociologists, affected people, NGOs + *Public "acceptance"*	Engineers, economists, affected people, sociologists, NGOs, environmentalists, + *Public "acceptance"*

Source: The U.S. case is revised from Goodland (1997, 77).
Note: New participants are denoted in *italic* type.

Sociologists and environmentalists were actively involved into the anti-dam campaigns, and successfully scrapped the Two Forks Dam in Colorado of the United States and the Youngwol Dam in South Korea (see chapter 4). They are recorded as the first veto cases after receiving preliminary governmental approvals in the water management histories in South Korea and the state of Colorado respectively.

Multi-disciplinary participation in water policy has been common in the United States, but it only emerged since the Youngwol conflict in South Korea. South Korea has also achieved a new form of public involvement since the late 1990s, with transparency and participation like the advanced countries initiated during the 1960s. Until the early 2000s, the public acceptance becomes the main factor to get approval of water development projects in the world except the underdeveloped countries.

3.3. The state level, Colorado and California

3.3.1. General characteristics

Two states, Colorado and California, are selected as case study states because their water policies are representative of the western United States but show important differences. Both states involve some similarities with South Korea, such as mountain regions, use of irrigation, flood problems, and water stresses. Along with other states, they share the Colorado River, even though their borders are not directly connected each other. California is mostly isolated with its west coast and Sierra Nevada Mountains in the east. It stretches long distances in longitude and borders on Mexico in the south. On the other hand, Colorado is bounded by other states on four sides, and its main four rivers flow out of the state (the Colorado, the South Platte, the Arkansas, and the Rio Grande).

Therefore Colorado has complex interstate water problems, while California deals with large scale intrastate matters. Table 3-3 compares the two case study states.

Table 3-3 General information of Colorado and California

Item			Colorado	California	References
Land size (㎢)			269,601	411,433	USCB(2002)
Water area (㎢)			974	7,500	USCB(2002)
Population (thousand persons)			4,418	34,501	USCB(2002)
Income ($/person)			30,095	29,840	USCB(2002)
Expenditures ($ billion)			13.9	141,7	USCB(2002)
Annual precipitation (mm)			402 (Denver)	455 (Sacramento)	USCB(2002)
Water withdrawal (million m³/year)	Use	Total	52.5	174.1	USCB(2002)
		Municipal	2.9	21.7	
		Industrial	0.7	3.0	
		Agriculture [1)]	48.5	112.9	
		Thermo-electric	0.4	36.5	
	Source	Surface	43.9	118.5	
		Ground	8.6	55.6	
# of reservoirs (NID dams)			1,652	1,490	NID [2)]

Note: 1. Rural water is classified as irrigation and groundwater.
2. NID: see section 3.3.3 footnote 56 for details.

Colorado has an average elevation of 6,800 feet (2,703 m) (Black and Fisher 2000, 178). Most Colorado residents live on the East Slope, which generally receives less precipitation than 15 inches and needs much municipal and irrigation water supply. On

the other hand, the West Slope has greater precipitation and transfers much water to the east side.

California's climate has distinct dry and wet seasons, and the state has humid northern parts and dry southern parts. More than 75% of the population lives in the south, while more than 75% of the precipitation falls in the north. This hydrological unbalance is similar to that of Colorado between the east and west slopes. Most of the big cities in California are along the Pacific coast, while most of the state's snowpack is in the Sierra Nevada mountains along the eastern part of the state (Bass and Herson 2000, 216).

3.3.2. Water rights system

Colorado follows a pure type of the prior appropriation doctrine while California has a hybrid system that first introduced the prior appropriation doctrine and mixed riparian rules with it later. The water law of California is even more complicated, as it has pueblo rights[55], which are an exception case to the prior appropriation doctrine. California is the only state to recognize pueblo rights clearly in the United States. The California Supreme Court held that Los Angeles and San Diego have prime rights to the Los Angeles River and San Diego River (Gould and Grant 1995, 47).

California requires permission to divert surface water, but not groundwater. In Colorado, permission is required for either. To resolve water disputes, Colorado established water courts, while California has a State Water Resources Control Board.

[55] A Pueblo means a city or a town in Spanish. This concept of Mexican law, stemming from the King of Spain, granted pueblos preferential rights in taking waters on the streams which the pueblos were located (AWWA 1990, 24).

Most of the water issues of the western states are represented by the experiences of Colorado and California.

Table 3-4 Summary of the water rights in Colorado and California

State		Colorado	California
Surface water right system		Appropriation	Hybrid
Permit system	Surface water	Yes	Yes
	Groundwater	Yes	No
Court approval	Surface water	No	No
	Groundwater	No	No
	Buying/selling	Yes	Yes
Disputes resolutions		6 Water courts	General courts
Number of compacts		11	3
Number of treaties		1	1
Legislative activity		Yes	Yes

Source: Selected and revised from AWWA (1990, 32).

3.3.3. Water management and dam construction

California has a state water plan and the Department of Water Resources is the leading water agency in the state. The California water management system is complex because many federal, state, and local water organizations are involved, and many water projects must be planned and operated, including the Central Valley Project, the State Water Project, and the Peripheral Canal Project. Currently, a new form of federal and state water plan is operating under the name of 'CalFed', as the new water paradigm to enhance voluntary partnerships among federal, state, and local interests.

Colorado does not have a state water plan. The Water Conservation Board formulates policy and administrates flood plain regulations and water project construction funds. The Division of Water Resources under the State Engineer regulates both surface and groundwater resources. The federal Bureau of Reclamation (BOR) and the local Denver Water Board (DWB) have been the two most important water development bodies in the state (Black and Fisher 2001, 175-9).

The main information sources about dams in California are the National Inventory of Dam (NID)[56] (currently 77,407 dams are listed including 1,652 in Colorado and 1,490 in California) and the California Dams Database[57] in which 1,395 dams are recorded. DWR Bulletin 17[58] (CDWR 1998) provides information about 1395 dams including 637 owners within California. In Colorado, the Division of Water Resources maintains a data base of dams.

Large dam construction in South Korea is similar to the Colorado state level process. Three main differences, however, are found: the water development body, planning stage, and the public hearing process. South Korea has MOCT as the leading water agency, while in Colorado the process is less-centralized, with prominent roles of the BOR and the DWB in the past. South Korea's national planning mechanisms[59] to propose a

---

[56] The Congress authorized the Army Corps of Engineers (COE) to inventory dams in the nation by the National Dam Inspection Act (P.L. 92-367) of 1972. The Water Resources Development Act (WRDA) of 1986 (P.L 99-662) authorized COE to maintain and periodically publish an updated National Inventory of Dams (NID). The WRDA of 1996 (P.L. 104-303), Section 215, also reauthorized periodic update of the NID by COE, and continued a funding mechanism; http://crunch.tec.army.mil/nid/webpages/nid.cfm.

[57] http://elib.cs.berkeley.edu/dams/about.html.

[58] http://elib.cs.berkeley.edu/kopec/b17/html/home.html.

[59] They are the Comprehensive National Territorial Plan as the supreme national plan, the long-term comprehensive plan for water resources as the framework plan on national

national water project are organized more clearly than those of Colorado. As to public hearings, KOWACO of South Korea offers public hearings at the final design stage[60]. In the United States, public hearings occur several times at the planning stage and design stage[61].

3.4. New thinking in the American water policy

Water resources have played a striking role in economic and social development in the West since the emergence of the American frontier (Kenney 1997, 1). The hydraulic mission[62] in the West started since the Reclamation Act of 1902. The mission brought about "the age of the modern engineers" and the supply-side water management in the West by conserving water with dams and pipes to fulfill increasing water demand (Turton 1999, 15).

During the first half of 20th century, water project was "a kind of currency" and water development was "a kind of religion" in the Congress (Reisner 1993, 308-9). The political reality characterized the Western water policy as traditions of log-rolling and pork barrel (ibid. 309) or a distinct of distributive politics[63] (Anderson 1997, 15-9; Lowi

---

water resources, and the Dam Construction Long-term Plan as the sectoral plan of MOCT (see section 6.2.1).

[60] In the past, MOCT and KOWACO regarded the process as only formal action to be cumbersome procedure required by the law. After the Youngwol conflict, however, MOCT promised to enhance public involvement mechanism by creating local forums in local areas from the beginning of basic planning stage (MOCT 2001a, 18). Therefore, the planning mechanism to develop water resources in South Korea becomes more open, transparent, and time-consuming process.

[61] The public hearings of Two Forks project were held by two water-related agencies, COE and EPA respectively (see chapter 4).

[62] See section 2.3.4.2 and footnote 17 for details.

[63] Distributive politics creates dispersed costs and concentrated benefits by allocating public funds or benefits to particular segments (groups, communities, industries)

1964, 689-95; Salisbury 1968, 36). Until the 1960s, these supply-side solutions made "water flows toward power and money" (Reisner 1993, 296) or "water flows uphill to money" (Bates 1993, 138).

In the 1960s, the environmentalism began to emerge with the battle for dams in the Grand Canyon and the demise of Echo Park Dam (Turton 1999, 17). After the federal environmental statutes of the 1970s (Wilds 1998, 3), the federal EPA began to exercise authorities to set national environmental standards and to require specific program activities to the states. The conflict between the federal government and the states emerged as the power of states increased and the states' rights[64] recognized. This intergovernmental conflict brought about a new thinking that reconsidered the traditional federal dominance over the states to displace command-and-control regulation with partnerships among federal, states, and locals.

Since the 1990s, water management at the watershed level has become a salient issue. With increasing needs for IWRM, effective water management requires cooperative efforts and extensive considerations from a host of interagency, intra-agency, and local residents. A variety of governmental and nongovernmental stakeholders gather to seek innovative and pragmatic solutions to water problems. The 1990s was "a proliferation of watershed initiatives" in the West (Kenney 1997, 1-3).

(Anderson 1997, 15). It was popular in the American water sector through pork barrel legislations or iron triangle decision-making process before the 1960s.

[64] The states' rights are the rights that belong to the States with strict interpretation of the Constitution. All rights not delegated to the federal government by the Constitution belong to the States; http://www.infoplease.com/ipd/A0669969.html.

The United States federal government also emphasized efficiency. The Government Performance and Results Act (GPRA)[65] of 1993 (Kraft and Scheberle 1998, 140) forced the federal agencies to adopt more efficient and effective policies to achieve greater performance or measure results[66]. This affects water and environmental policies in that less funding is available to distribute (Alegre et al. 2000; Beck et al. 1999; Deb et al. 1995; EPA 2002; Winograd et al. 1999).

The new paradigm shifts towards place-based management, ecosystem management, watershed management, or redistributive politics[67]. The new water policy also focuses more on demand-side water management, market incentives and full-cost pricing, away from supply-side management (Babbit 2000).

3.5. From development to management in water policy

In the United States, many landmarks shaped water policy during the 20th century. In recent decades, the report of the National Water Commission (NWC) in 1973, President Carter's water policy in 1978, and President Reagan's approach in 1981 are the prominent water policy reforms. The NWC's *Water Policies for the Future* announced the emerging paradigm from water development to environmental protection. President Carter's *Water Policy Initiatives* translated the changing water paradigm into a

---

[65] The objective of the GPRA is to improve the efficiency and effectiveness of the federal programs through setting performance goals and evaluating results. GPRA consists of four components: planning, budgeting, measuring, and reporting (Kim-Shin 2000; Mihm 2001; GAO 2000).

[66] The federal water agencies documented their performance improvements and enhancements in their published reports (EPA 1997; EPA 1999a; EPA 1999b; TVA 1999; TVA 2002a; TVA 2002b).

[67] Redistributive politics is difficult to implement because it reallocate resources (money, rights, or power) from haves to have-nots (Anderson 1997, 18). Water transfer and water bank are good examples in the water sector.

government policy. Reagan's administration embodied 'New Federalism' [68] by increasing the level of non-federal cost sharing for water projects and programs (Viessman 1998; Bulkley 1995). Carter and Reagan both intended to transfer some responsibilities of water programs to the states and reduce the funding load of the federal government by advocating states' rights.

The paradigm shift resulted in a drastic reduction of dam construction after 1965 in the United States. Capital outlays for federal water resources projects peaked in 1965, and by 1985 they were less than 50% of their peak value. The number of new dam constructed was 275 during five years from 1961 to 1965, 150 during 1976 to 1980, and less than 20 during 1986 to 1990 (Moreau 1998, 9-10).

Table 3-5 Evolutionary history of water management in the United States

Stage	Concept	Approach	Main actions
Early age	Comprehensive approach	Multi-use impoundment project	River & Harbor Act (1927)
1930s-1960s	Integrated River Basin Management	Unified management of land and water	TVA (1933) WRPA (1965)
1970s-1980s	New Pluralism (Environmental movement)	Critical to public sponsored project, Public involvement	NEPA (1969), EPA (1970) CWA (1972), ESA (1973)
1990s	Integrated Water Resources Management	More integrated ecosystem approach	Rio Statements (1992)

Source: Summarized and revised from Margerum (1995, 37-8).

[68] By the 1980s, the States played leading roles in manage water resources as the States became powerful. The federal government encouraged the State to lead in water management innovations and the State responded with the recognition of the states' rights (Kenney 1997, 'A-36'-'A-37').

The water policy history in the United States shows four main concepts as in Table 3-5 since the beginning of the 20th century: comprehensive approach, integrated river basin management, new pluralism with the environmental movement and Reagan's New Federalism, and integrated water resources management (Margerum 1995, 37-8).

Table 3-6 Evolutionary history of dam construction in South Korea

Decade	Policy position	Focus
Before 1960s	◦ Construction of small and single-purpose dam for irrigation and hydro-generation	U
1960s	◦ Active surveys for major river basins ◦ Beginning age of large-size multi-purpose dam construction	U
1970s & 1980s	◦ Rapid economic growth ◦ Golden age of large-size multi-purpose dam construction	U + F
1990s	◦ Consideration of environmental values ◦ Transition to medium-size multi-purpose dam construction	U + F + E
2000s	◦ Consideration of public acceptance (ripple effect of scraping Youngwol dam project) ◦ Transition to environmental friendly dam building	ESSD

Source: Summarized from MOCT (2001a, 4-5) and KOWACO's dam website at http://www.water.or.kr/korwater/general/kwk_gel_dev_dam.html?menu=mn3_1_1.
Note: U- water utilization; F- flood control; E- environmental consideration; ESSD- environmentally sound and sustainable development.

A similar story occurred in South Korea as in Table 3-6. The river basin management strategies of TVA were introduced into South Korea since the late 1960s. South Korea had an era of large-size multi-purpose dam construction during the 1970s and the 1980s.

The year 1987 was the pivotal point for both political democracy and environmental policy in South Korea. With suddenly-arrived political freedom and administrative deregulation, South Korea experienced the era of new pluralism since the late 1980s. New policy players emerged in the environmental sector to influence the water policy process. In effect, it was the emergence of Korean civil society. Finally, under the influence of the UNCED (see section 2.4.4) of 1992 and the ripple effect of the Youngwol conflict (see section 4.6), South Korea embraced IWRM since the late 1990s.

3.6. Lessons for South Korea

The United States has elaborated its water policies from painful trials and errors of the previous generations. The following generations have learned precious lessons from the history or a set of past experiences to look back what the past decision-makers thought and how they decided (Rogers 1993, 45). Getting experiences from past generations or developed countries is very important for the developing countries to implement successful water policies.

South Korea has followed a similar path to the United States for constructing large dams since 1960s. It took nearly 100 years for the United States to advance from water development initiatives to IWRM. South Korea followed the very similar process during the last four decades from the early 1960s. Thus, a lot can be learned from looking back of the American experiences to find reasonable solutions for today's and tomorrow's water issues in South Korea.

Period	United States	South Korea
1930	The New Deal Single purpose projects	River improvement for flood
1940	Water supply for economic growth Multi-purpose projects	
1950	Rapid economic growth Basin-wide planning	Small single-purpose dam Irrigation & hydro-generation
1960	Affluent society Concerns for env. aesthetic Environmental movement	Beginning of economic growth Beginning of multi-purpose dam
1970	Environmental era Carter's hit list	Acceleration of economic growth Golden age of multi-purpose dam
1980	Cost sharing policy Public acceptance Two Forks conflict	Affluent society Political democratization
1990	Privatization IWRM; Water bank	Concerns for env. aesthetic Environmental movement Youngwol conflict
2000		Public acceptance IWRM

Legend: Economic development; Regulation; Market

Figure 3-3 Comparative water resources management and policy

However, South Korea has to face tough challenges to advance into more efficient and more effective management of water resources. The old water paradigm includes water policies under command and control, government-led, top-down, and regulatory mechanism. On the other hand, the new water paradigm leads to voluntary, community-based, bottom-up, and participatory water management strategies. This paradigm shift will introduce difficult transitions for South Korea.

In the next chapter, I will discuss about two failed water projects in the two countries to understand regional water development practices. Even though both water projects resulted in futile fruits in each country, they illustrate the images of the new water paradigm that significantly affected in formulating regional water policies in South Korea and the United States. The focus of the chapter is to discuss how the new paradigm at international and national levels affected the water development projects at local level.

4. Comparative analysis at the project level: Youngwol Dam vs. Two Forks Dam

4.1. Purpose of chapter

This chapter explores the outcomes of the new paradigm at work at the project level in South Korea and the United States. Two canceled dam projects, Youngwol Dam in South Korea and Two Forks Dam in Colorado of the United States, illustrate how the new paradigm applies to regional water projects because they became victims of environmental opposition in the new paradigm. While the cases have no apparent close relationships and they occurred in different decades, they offer interesting comparisons.

The two water conflicts show why the new paradigm is important, how it will change water policies in both countries, who should apply it, and what the effects will be. It also indicates differences between the Korean case and the American case and shows what factors should be recognized to apply the new paradigm in South Korea.

4.2. Dam construction projects

The Youngwol conflict occurred during the burgeoning of civil society and emergence of environmental issues since the democratic transition that began in June 1987. Social movements shifted from resistance against the military government to citizen movements to solve social problems. The environmental movement emerged during the early 1980s and led to the Youngwol conflict in the late 1990s.

Two Forks Dam was designed to supply water to the Denver metropolitan area by constructing a double curvature thin arch concrete dam. Youngwol Dam was to be a

multi-purpose and concrete faced rockfill dam. The detailed descriptions of the two dams are in Table 4-1.

Table 4-1 Dam construction plans of Youngwol and Two Forks

	Youngwol Dam	Two Forks Dam
Location	South Han River (Kangwon, South Korea)	South Platte River (Colorado, USA)
Responsible agency	MOCT, KOWACO	Denver Water Board
Policy period	1990-2000	1979-1992
Major objective	Multi-purpose	Water supply
Proposed period	1998 - 2001	-
Proposed cost	1,066 billion won ($753 million[69])	$440 million (as of 1988)
Dam type	Concrete faced rockfill dam	Double curvature thin arch concrete dam
Dam height	98 m	187 m (615 feet)
Dam length	325 m	518 m (1,700 feet)
Rive bed altitude	291.5 m	1,835 m
Storage capacity	698 million m^3	1.4 km^3 (1.1 M acre-ft)
Water surface area	21.9 km^2	29.5 km^2
Watershed area	2,267 km^2	⅔ of water comes from the East slope
Water supply	367.1 million m^3/year	121 million m^3/year
Generation	9,800 KW x 2 unit	-

Source: Park (2002, 89); Katsuhama (2003, 79).

[69] Apply 1,415 won to the U.S. dollar based on the official exchange rate of 1997 from the Korea National Statistical Office at http://www.nso.go.kr/kosisdb.

A policy decision-making process on conflicting social issues requires long-term periods and enormous financial resources. The Youngwol and the Two Forks projects experienced the same situation. The scrapping of the Youngwol project required approximately nine years to resolve the conflict and over 10 billion won ($8.3 million[70]) to conduct its feasibility studies (Song 2000, v). The Two Forks project died at the cost of 10 years and over $40 million for the EIS analysis (Adams 1998, 117). The feasibility study costs of both projects would be much higher than the official funding amounts considering the hidden social costs.

The Two Forks project was proposed by DWB to provide water supply in the Denver metropolitan area, and rejected by the federal EPA Administrator William Reilly. The Korean MOCT suggested the Youngwol project for dual purposes of water supply and flood control and the then-president Kim Dae-Jung scrapped it.

4.3. Case study of Youngwol Dam

4.3.1. Youngwol Dam and reservoir

The proposed site of Youngwol Dam is located at the Tong River, a tributary of the South Han River. The Tong River flows approximately 51 km through rugged limestone terrain in a mountainous area of Kangwon Province (Hong 2000, 112). The river is known as an ecological treasure trove providing a home to 1,840 different animals and 956 plants[71]. It is also famous for breathtaking scenery with serpentine streams, pristine and serene atmosphere with virgin territory, many dolmens and historical remains with

[70] Apply an approximate exchange rate of 1,200 won to the U.S. dollar.

[71] "Tong river basin to be designated as National Conservation Area," *The Korea Times* (Seoul, South Korea), 7 August 2002.

intangible cultural assets, and precious ecological resources with a wealth of rare flora and fauna including some endangered species and rare animals.

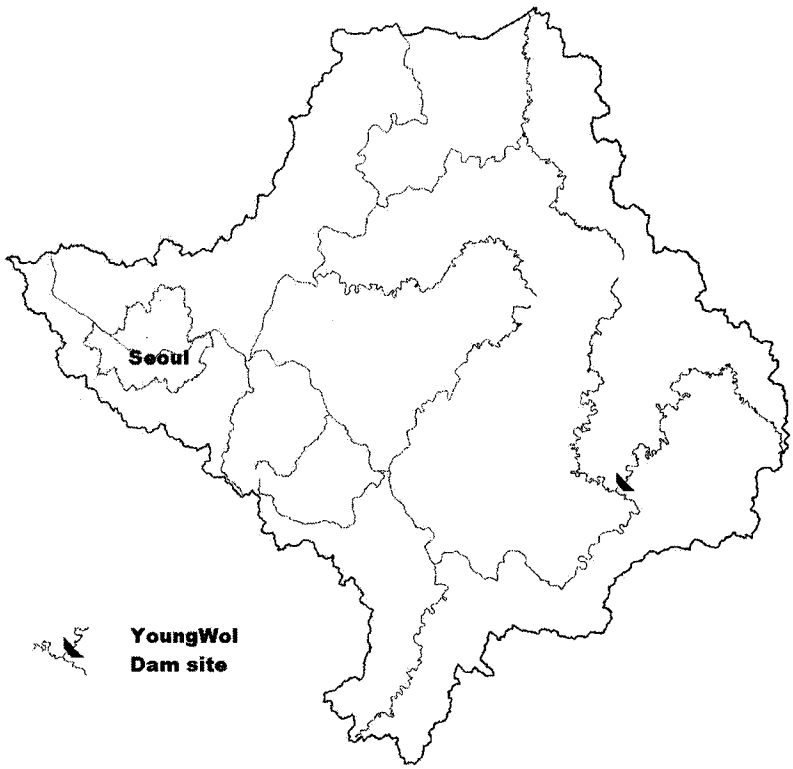

Figure 4-1 Han River basin and Youngwol dam site

4.3.2. Stakeholder involvement

The Youngwol case was a struggle between water development interests and environmentalists. The governmental ministries, the Ministry of Construction and Transportation (MOCT)[72] and the Ministry of Environment (MOE)[73], had been involved in an EIS process of the Youngwol project before the local residents participated in the

[72] It is the leading policy player in building multi-purpose dams and executes dam construction and operation jobs through KOWACO; http://www.moct.go.kr.

[73] MOE, like EPA in the U.S., is responsible for environment protection and water quality sectors and generally opposes water development projects; http://eng.me.go.kr.

conflict. The development coalition included MOCT and Korea Water Resources Corporation (KOWACO)[74], water experts, and some local residents[75]. The protection coalition was led by the Korean Federation of Environmental Movement (KFEM)[76], and included MOE, Ministry of Culture and Tourism, Kangwon Provincial government, local county governments, environmental experts, major local residents, and a variety of social circles including religion, mass media, writers, painters and more. The development coalition was overwhelmed by the environmental coalition in the number and the diversity of participants.

As neutral governmental bodies, the Water Policy Coordination Committee (WPCC)[77] and its executive body, the Commission on Protection of the Quality and Supply of Freshwater Resources (CPQSFR)[78], were involved in the conflict, but not successful in coordinating the water conflict issue. Thus, the WPCC established the Joint Task Force for Comprehensive Feasibility Study on Youngwol Dam (Joint Task Force or JTF)[79] to conduct additional comprehensive examination for the project again at a zerobased stage.

---

[74] It is a quasi-government organization that deals with the national water resources management; http://english.kowaco.or.kr.

[75] The local residents had separated opinions on the project until 1997. Some residents welcomed the project and others opposed it. However, anti-dam attitudes took precedence after about 1998.

[76] KFEM was established in 1993 and now is the largest environmental group in South Korea. It first opposed the project in 1997, had a temporary lull, and got seriously involved in the conflict from March 1999; http://www.kfem.or.kr.

[77] WPCC, established under the Prime Minister Office, is the supreme organization for managing the national water (CPQSFR 2002a, 306).

[78] CPQSFR was established in 1997 with 22 staff as the working organization of the WPCC. Despite of their important functions, WPCC and CPQSFR are not considered as strong players in the water sector.

[79] The JTF was formed in August 1999 as an ad-hoc working organization. It consisted of 33 professional experts, covering extensive interdisciplinary fields from natural science to social science. Conflicting stakeholder interests - MOCT, MOE, KOWACO, environmental community, local residents, etc. - selected the whole members of JFT.

Table 4-2 Stakeholder interests involved in the Youngwol Dam project

Coalition	Stakeholder interests
Development coalition	Ministry of Construction and Transportation, Korea Water Resources Corporation, water resource experts, minor local residents, etc.
Protection coalition	Ministry of Environment, Ministry of Culture & Tourism, Kangwon provincial government, local municipalities, major local residents, environmental groups, environmental experts, religious circles, mass media, cultural organizations, etc.

The issue of Youngwol was a matter of interministerial conflict between MOCT and MOE. It was not a hot issue until the beginning of 1999 when KFEM began to involve in the conflict. The issue finally became an emblematic event (Hajer 1995, 265) until March 1999. As a result, WPCC as the water policy coordination body and political circles turned to the issue. WPCC formed a task force to deal with the issue to look back the feasibility study from a zerobased stage. The conflict appears to be resolved by active involvement of the Joint Task Force externally; however, the then-President played a decisive role to make the final decision in the policy process. Detail descriptions will be discussed in section 4.5.

Table 4-3 Evolution of stakeholder involvement in the Youngwol conflict

Stage	Major policy actors	Additional actor	Notes
1	MOCT, MOE		◦ KOWACO sent the draft EIS to MOE. ◦ EIS process (1996-1997)
	←	Local residents	◦ Local residents recognize details of the draft EIS during EIS process.
2	MOCT, MOE Local residents		◦ MOCT begins to persuade the residents. ◦ MOE intentionally delays the EIS review.
	←	KFEM	◦ KFEM raises an issue on Youngwol Dam. ◦ KFEM initiates an anti-dam campaign.
3	MOCT, MOE Local residents KFEM		◦ MOCT justifies it through water experts. ◦ MOE officially opposes against the project.
	←	CPQSFR	◦ CPQSFR plays a policy broker's role to resolve interministerial policy conflict.
4	MOCT, MOE Local residents KFEM, CPQSFR		◦ MOCT tries to make a fait accompli. ◦ MOE acts in union with KFEM.
	←	Political circles	◦ Members of the National Assembly begin to comment on the conflict.
5	MOCT, MOE Local residents KFEM, CPQSFR Political circles		◦ MOCT takes a strategic retreat against a strong outside opposition. ◦ MOE & KFEM suggest demand-side management measures for the alternative.
	←	Task Force	◦ All policy actors agree to form the JFT to re-study feasibility of the project from a zerobased stage.
6	MOCT, MOE Local residents KFEM, CPQSFR Political circles Task Force		◦ The JFT consists of 33 experts who are recommended by major policy actors. ◦ The final report suggests canceling it. ◦ The President plays a decisive role.

4.3.3. Diverging arguments

The environmentalists revealed a significantly contrasting viewpoint from that of MOCT on the Youngwol project. The environmental groups criticized MOCT and KOWACO for their organizational egoisms in proposing the project. On the other hand, MOCT refuted that the opinion of the environmental groups was only an idealistic thought ignoring urgent water scarcity. MOCT also referred to the project as the best alternative to resolve the national situation under the danger of water shortage and flood damages.

Table 4-4 Conflict structure of Youngwol dam project

Conflict item	Viewpoints of developers	Viewpoints of environmentalists
World view	Anthropocentrism	Biocentrism / Ecocentrism
Human vs nature	Human is superior to nature	Human is only a part of nature
Value priority	Economy, material living standard	Ecological & environmental value
Understanding on dams	Water supply and flood control as basic governmental duties	Destruction of nature & ecosystem, inefficient use water resources
Policy decision	By professional expertise	By extensive public involvement
Primary policy	Supply-side management	Demand-side management
Benefits of dams	Substantial benefits to human	No benefits, long-term loss
Major advocates	MOCT, KOWACO, etc.	KFEM, MOE, civil society, etc.
Academic background	Hydrology, water resources, etc.	Environment, economics, sociology, etc.

The battle between MOCT and environmental groups was not a simple problem to build just one multi-purpose dam on the Han River. They shared fundamentally different paradigms regarding water resources. The basic norm of MOCT was anthropocentrism as the then-minister commented in a television program that "even though the construction of the dam will affect the ecosystem somewhat, it is not more important than the life and property of people" (MOCT 1999). On the contrary, the viewpoint of environmental groups was focused on the deep ecology (Park and Yi 2001).

4.4. Case study of Two Forks Dam

4.4.1. Two Forks Dam and reservoir

The location of the proposed Two Forks dam was two miles below the confluence of the South Platte River and the North Fork, along the Jefferson-Douglas county line, which is situated approximately 24 miles southwest of Denver and approximately 40 miles northwest of Colorado Springs, Colorado. It has been an attractive dam site since the 19th century for its massive amount of water storage capacity with a narrow valley and steep walls. Additionally it is easily accessible from Denver. Those geographical characteristics have already contributed to construct several impoundments in the south side of Denver. Two Forks Dam would have been the sixth dam if it succeeded (Sweetser 1994, 9; Luecke 1990, 42; EPA 1990, 2; COE 1989a, 13; FWS 1987, 4).

4.4.2. Stakeholder involvement

The Two Forks Dam project was basically a struggle between water development coalition and environmental protection coalition on regional water conflict. The

development coalition consisted of the Denver Water Board (DWB) and the Metropolitan Water Providers (MWP) as the main beneficiaries, and eastern slope water conservancy districts, agricultural economy interests, developers, labor and industry leaders, real estate officials, chambers of commerce, ranches, suburban leaders. They significantly favored building the dam to continue growth and independence.

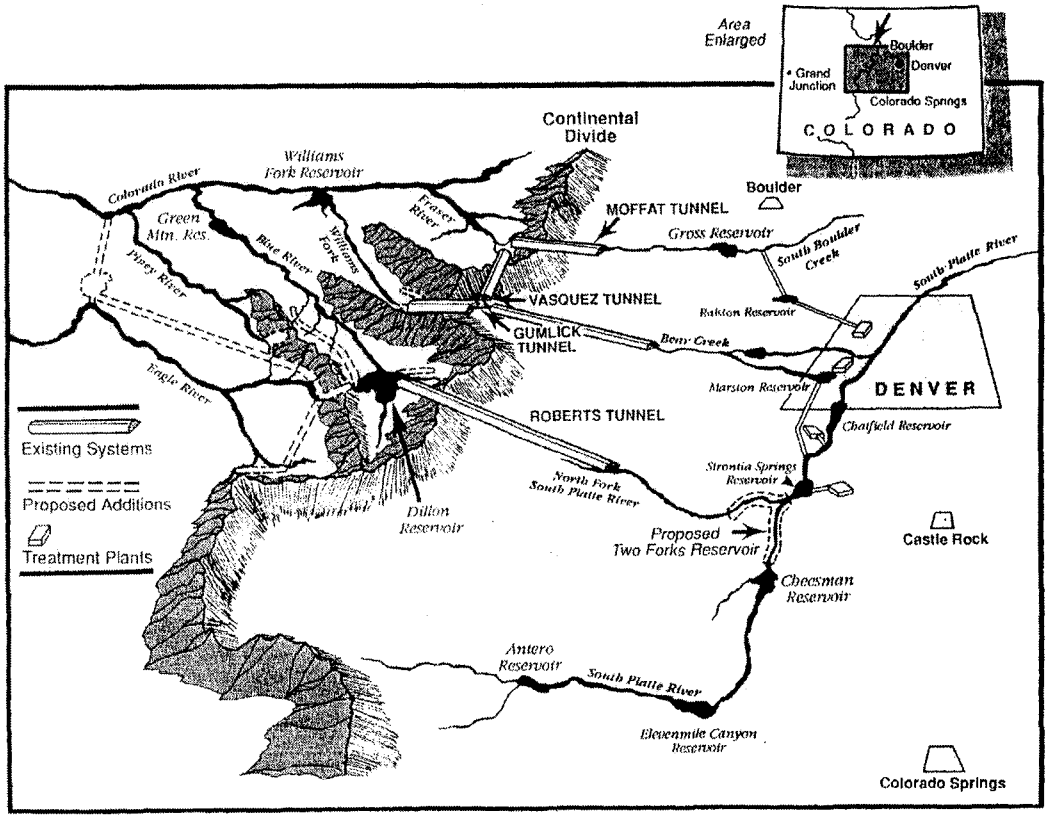

Figure 4-2 Denver water system and Two Forks Dam site[80]

On the other hand, the protection coalition was led by the Environmental Caucus, an umbrella organization of fifteen groups including the Sierra Club and the Environmental Defense Fund. The protection coalition also included some western slope water

[80] From Hinchman (2000, 199); Permission from the publisher.

conservancy districts, citizens' groups, conservation groups, outdoor activity groups, and residents of Deckers to be relocated.

Table 4-5 Stakeholder interests involved in the Two Forks Dam project

Coalition	Stakeholders
Development Coalition	DWB, MWP, State of Colorado, City of Denver, Suburban governments, Eastern slope water conservancy districts, Agricultural economy interests, Labor groups, Denver Regional Council of Governments, The Colorado Homebuilders Association, etc.
Protection Coalition	EPA, FWS, Environmental Caucus, West slope community, Nebraska (Downstream interest), etc.

Alison Adams identified ten dominant players, individually or collectively, during the Two Forks conflict: DWB, Citizens Advisory Committee(CAC) of DWB, MWP, Governor's Metropolitan Water Roundtable (Roundtable), the Environmental Caucus, the Western Slope Advisory Council (WSAC), Army Corps of Engineers (COE), EPA, Colorado State Governor, and Mayor of Denver. She classified them into the primary players who made decisions and the influential players who had significant influence on other players or within a process. The primary players were identified as DWB, COE, EPA, Governor's Roundtable, Colorado Governor (Lamm and Romer). The influential players consisted of Environmental Caucus, WSAC, CAC, MWP, and Denver Mayor (Adams 1998, 119, 187, 395-410).

Table 4-6 Evolution of stakeholder involvement in the Two Forks conflict

Stage	Major policy actors	Additional actor	Notes
1	DWB		◦ The Foothill conflict is resolved in 1979. ◦ DWB prepares to build Two Forks.
		MWP, Governor	◦ Governor creates the Roundtable in 1981. ◦ 42 suburbs create MWP in 1982.
2	DWB, MWP Governor		◦ Roundtable begins to discuss water issues. ◦ The cost sharing of Two Forks is decided.
		COE	◦ COE begins to work a Systemwide Environmental Impact Statement (SEIS).
3	DWB, MWP Governor, COE		◦ Roundtable endorses expanding of SEIS. ◦ DWB requests COE to include Two Forks.
		West Slope Env. groups Political circles	◦ Public hearings on the draft EIS held by COE in 1987. ◦ Strong oppositions against the project.
4	DWB, MWP Governor, COE West Slope, Envs. Political circles		◦ DWB & COE try to persuade West Slope. ◦ West cooperates with environmentalists. ◦ Senates & Congressmen begin to comment.
		Regional EPA	◦ Regional EPA concerns over the site.
5	DWB, MWP Governor, COE West Slope, Envs. Political circles Regional EPA		◦ DWB releases a Mitigation Plan. ◦ Regional EPA rates EU-3 on draft EIS. ◦ COE releases final EIS. ◦ COE issues a 404 permit.
		Federal EPA	◦ Mr. Reilly orders CWA 404(c) process.
6	DWB, MWP Governor, COE West Slope, Envs. Political circles EPA (R&F)		◦ President Bush declares not to intervene. ◦ DWB releases a Resources Statement. ◦ EPA holds 3 public hearings in Oct. 1989. ◦ EPA vetoes the 404 permit in Nov. 1990.

4.4.3. Diverging arguments

The primary benefit of the proposed Two Forks project would be the additional water supply to the Denver metropolitan area from 295,000 acre-feet to 393,000 acre-feet in annual yield basis. The augmented water supply would be possible at an expense of many adverse effects on environmental and human. The main opposing issues emerged from dangers of flooding the heavily used canyon, threatening endangered species downstream, salinity increasing in the Colorado River, degradation of quality in the western slope water basin (Sweetser 1994, 21-22).

The fundamentally different perspectives between proponents and opponents could not be converged into a unified negotiation. The conflicting opinions were acutely exposed in the most issues as in Table 4-7.

4.5. Comparative analysis

4.5.1. Conflict resolution mechanism

A governmental organization generally assumes a firm attitude against its opponents in dealing with policy matter when it has enough resources including power and expertise, or a flexible attitude without them. The more the number of policy actors in a policy process increases, the more complex the issue becomes. Thus, the policy strategies that the government organization can choose will change according to the structure of policy process, the resources it possesses, or the issue agendas it holds (Joo and Hong 2001).

Generally there are three policy mechanisms in a government-initiated water policy process: interministerial conflict, conflict with local residents, and conflict with environmental groups. The three principal policy actors in the process are governmental

organizations, local residents, and environmentalists. The mechanism of interministerial conflict is rather simple and easy to reach a compromise than conflicts with local resident and environmental groups. A primary governmental organization will follow procedural steps officially provided by laws, regulations or guidelines. It can assume more friendly action or more hostile action under the existing institutional frameworks.

Table 4-7 Conflicting arguments on Two Forks project

Item	Proponent	Opponents
Necessity	◦ Necessary and urgent - ensure long-term water supply - support regional growth - maintain residents' lifestyles	◦ Not necessary - mistake in demand projections - preclude effective conservation - water for bluegrass lawns
Alternatives	◦ No better alternative exist	◦ Alternatives are conservation, recycling, and smaller projects
Economic efficiency	◦ Reliable and most cost-effective ◦ Contribute to economic growth	◦ The B/C in the final EIS is low ◦ Burden to taxpayers
Mitigations	◦ DWB's proposal is enough ◦ More is costly & unreasonable	◦ The loss can not be mitigated ◦ Mitigation plan is uncertain ◦ Out-of-kind mitigation is too dangerous
Recreation	◦ Reduce water level fluctuation ◦ Provide more flatwater recreation	◦ Destroy recreational opportunities ◦ Loss of recreation/scenic values
Water quality	◦ Not serious to water quality	◦ Violate water quality standards ◦ Increase salinity in Colorado River
Urban growth	◦ Growth is inevitable ◦ Prepare to accommodate growth	◦ Promote economic growth in Denver area at the expense of West ◦ Aggravate existing problems
Fish & wildlife values	◦ DWB's mitigation plan is enough	◦ Impacts are wide ranging & not mitigable
25-year Permit duration	◦ Need for sound water planning ◦ DWB's request should be granted	◦ Proof of needlessness at this time ◦ Enough time to find alternatives

Source: Summary of public comments at the COE's public hearing (COE 1989a, 42-4).

The conflict structure becomes more complex when the local residents participate in the conflict. The primary organization will exercise more diverse tactics to persuade or allure the local residents. It can be exercised through conferences, public hearings, or informal meetings to justify the project, or reach a trade-off with compensation.

The governmental body may be involved into a very intricate mechanism – conflict with environmental groups - when environmental groups participate in the policy process (Joo and Hong 2001). A third neutral coordinating body may be necessary to reach a compromise when confronting with strong oppositions from the environmental groups.

The Two Forks case was basically a regional water dispute between the local agency DWB and the federal agency EPA. Another federal agency COE also deeply involved in the conflict as the leading federal agency of Systemwide Environmental Impact Statement (SEIS), and more importantly as the permitting agency of 404(c) of CWA[81]. Environmental groups also deeply involved in the process and were successful in persuading the elected officials and the general public. But they could not lead the policy process as principal policy actors unlike the Korean environmental groups did in the Youngwol case[82].

---

[81] However, COE assumed an irresolute attitude on the sensitive 404 process instead of playing a decisive role as the leading agency, COE was very careful to be involved in this hot debate even by chance during the EIS and 404 permit processes despite of its implicit support for the construction of Two Fork project. Therefore, COE was important, but not decisive agency in the process because it waited without exercising key actions until the dispute between DWB and EPA came to a settlement.

[82] The United States has well-established environmental laws and regulations, thus the necessary policy process is just to follow documented mechanisms. Therefore, the American water policy process can be regarded as a procedural policy mechanism. It also contributes to prevent excessive intervention of the environmental groups in the water policy process.

In case of Youngwol, environmentalists had enough room to intrude the policy process within insufficient institutional frameworks of not well-established environmental statutes. Once they found they had more resources than MOCT, they mobilized their anti-dam campaign across the country and enjoyed a dominant position over the development coalition in the policy process. The result of KFEM's superiority over MOCT and KOWACO drew a new coordinating mechanism, the Joint Task Force, and finally contributed decisively to scrapping the Youngwol project.

4.5.2. Policy actors

Many policy actors were involved in the Youngwol and Two Fork conflicts. Both cases saw fierce oppositions from outside-of-government stakeholders when the developers announced their intentions to build large dams. The outside-of-government stakeholders consisted of environmentalists, local residents, a variety of citizen's organizations, and etc.

In the Youngwol case, it started initially from an interministerial dispute as usual. The outside opposition against the dam construction came from the local residents in the first and later the environmentalists represented by KFEM. The environmentalists intervened into the policy process in close cooperation with the local residents. With increased conflict between development and environment, the CPQSFR and political circles tried to mediate the conflict, but in vain. The Joint Task Force was finally formed to re-study the project and suggested the project scrapping in its final report.

However, the policy decision-making to reject the Youngwol project was much influenced by political considerations. The President and the ruling party of South Korea

significantly worried about the adverse impact on the upcoming general election in April 2000. The opposite party also concurred with the residents' view, insisting that the dam project should be scrapped.

Table 4-8 Major stakeholder interests in the two projects

Youngwol project	Stage	Two Forks project
MOCT, MOE	1	DWB
MOCT, MOE, Local residents	2	DWB, MWP, Governor
MOCT, MOE Local residents, KFEM	3	DWB, MWP, Governor, COE
MOCT, MOE Local residents, KFEM CPQSFR	4	DWB, MWP, Governor, COE West Slope, Political circles Environmentalists
MOCT, MOE Local residents, KFEM CPQSFR, Political circles	5	DWB, MWP, Governor, COE West Slope, Political circles Environmentalists, Regional EPA
MOCT, MOE Local residents, KFEM CPQSFR, Political circles Joint Task Force	6	DWB, MWP, Governor, COE West Slope, Political circles Environmentalists Regional EPA, Federal EPA

In the Two Forks case, DWB initially announced a plan to build Two Forks reservoir in conjunction with the Foothills project. Colorado Governor and suburbs water providers (MWP) helped DWB in building the project from the beginning stage. The West Slope and environmentalists actively participated later to oppose the trans-mountain project and protect adverse damages to the environment. Political circles tried to mediate as they did in the Foothills controversy, too.

COE was involved in the Two Forks conflict as the leading agency of the System-wide Environmental Impact Statement (SEIS) required by the Foothills Consent Decree[83], but it was in an uneasy situation between DWB and EPA. COE delayed releasing the SEIS draft report beyond the expected deadline of August 1984. In response to COE's delay, DWB threatened COE to preempt SEIS by filing a 404 permit on Two Forks. COE finally agreed to combine the site-specific EIS on the condition of not filing the permit at the time. However, DWB became impatient and filed the permit two years before COE completed the final EIS (Luecke 1990, 44). DWB urged COE to include Two Forks reservoir in the site-specific EIS as a promising alternative.

---

[83] The DWB proposed the Foothill project which consisted of Strontia Springs Dam, Foothills Treatment Plant, and associated tunnels and distribution system to deliver water to the Denver metropolitan area. The proposal brought an intensive controversial debate and huge oppositions from environmental groups, western slope communities, and the hostile federal agencies EPA, BLM, FWS, and USFS (Sweetser 1994, 13; Ellison 1993, 104-7). These resulted in a settlement agreement, known as the Foothills Consent Decree, in February 1979. The Decree led DWB to conduct a water conservation plan and a system-wide water supply analysis before construction of the next major project. Later, the system-wide water analysis became the basis to carry out SEIS in determining site-specific and cumulative affects of the Two Fork project (Sweetser 1994, 13; EPA 1990, 6, 'B-1'-'B-2'; COE 1989a, 16, 64; Luecke 1990, 43). The Foothills controversy led DWB to recognize a paradigm shift from easy development period into a new era of public participation. Thereafter DWB would no longer construct water facilities without intervening or approval of a variety of antagonistic stakeholders.

EPA was the countervailing agency against DWB in the policy process because one of the EPA' roles is to protect the national environment against water development agencies. In the first, DWB managed to tide over the intergovernmental conflict by persuading the regional EPA successfully not to oppose the Two Forks project. However, the conflict became greater with involvement of the federal EPA.

During the CWA 404 permit, many staffs in the EPA Denver regional office opposed giving a permit for the project. However, the EPA's Denver regional administrator James Scherer approved it by a tacit consent and recommended the federal EPA to issue the 404 permit. The dramatic reversion came from the federal EPA administrator William Reilly (Luecke 1990, 43). Thus, with COE's intensive EIS study and EPA's critical review on the project, the administrative decisions had been reversed twice in the same EPA system – the regional and federal levels – according to personal sentiments.

4.5.3. Policy strategies

The policy strategies to implement water projects were quite different between DWB and MOCT. The Colorado DWB first rallied friendly proponents to reserve rationales and resources. Then, DWB persuaded West Slope with carrots for western slope interests. Third, DWB started to confront with the hostile federal environmental agencies and environmentalists when DWB considered proper preparation was ready. During the conflict with them, DWB always justified the necessities to build the dam and sometimes made it a fait accompli under a tacit consent of the regional EPA administrator. The final step was trying to get approval from the federal EPA by pressing the President and the federal government.

The Korean MOCT implemented completely different steps to build the dam. MOCT first tried to enforce the project without considering the outside opponents. When MOCT was challenged with strong opposition from the local residents and the environmentalists, MOCT hastened to persuade the local residents with some carrots and rallied friendly proponents to reserve rationale and resources; these were the first and second steps in the DWB case. With strong oppositions from the hostile environmental ministry MOE and environmentalists, MOCT tried to justify the necessities to build the dam and sometimes made it a fait accompli under a tacit consent of the Presidential Office.

As explained above, DWB and MOCT adopted completely different strategies in building the dams. The strategy of DWB was to rally friendly proponents → persuade West Slope → confront with opponents → justify and make a fait accompli → try to enforce the project. On the other hand, the strategy of MOCT was to try to enforce the project → confront with opponents → persuade the local residents → rally friendly proponents → justify and make a fait accompli.

Generally speaking, a water agency selects one or more strategies to adopt its favorable policies. The agency will select the most effective strategy based on its policy-oriented learning[84]. MOCT and DWB adopted different policy strategies because they had different past experiences despite of their similar belief systems[85]. DWB adopted a soft strategy to build the dam because DWB had already experienced hostile opposition from the environmentalists during the Foothills controversy in the late 1970s. As DWB

---

[84] Policy-oriented learning is "an ongoing process of search and adaptation motivated by the desire to realize core policy beliefs" (Sabatier and Jenkins-Smith 1993, 44).

[85] Belief system is "a set of basic values, causal assumptions, and problem perceptions" (ibid. 25). It consists of three structural categories: deep (normative) core, near (policy) core, and secondary aspects (ibid. 30-1).

acquired a policy-oriented learning during the confrontation with outside opponents, it gave up hard strategies since the Foothills controversy.

Table 4-9 Comparison of policy strategies of MOCT and DWB

MOCT, South Korea	Stage	DWB, Colorado
Enforce the project	1	Rally friendly proponents
Confront with opponents	2	Persuade West Slope
Persuade local residents	3	Confront with opponents
Rally friendly proponents	4	Justify the needs Make a fait accompli
Justify the needs Make a fait accompli	5	Enforce the project
Opposition spreads and intensifies	6	Opposition spreads and intensifies
Cancel		

On the other hand, the Korean MOCT adopted a hard strategy against local residents and the environmentalists as usual because they did not experience such enormous outside opposition until the Youngwol conflict. Thus, MOCT initially prepared for the interministerial policy coordination with MOE without recognizing the fierce battle against outside opponents.

4.5.4. Policy process

According to newspaper articles of *Chosun Ilbo* and *Hankyoreh Sinmun*[86] for the Youngwol case and the Denver Post[87] for the Two Forks case, the characteristics of policy processes on the Two Forks and the Youngwol projects were nearly identical as they were composed of three stages from beginning to end of the conflicts.

The public interests had significantly fluctuated from time to time, but culminated in Spring of 1999 on Youngwol and in Summer of 1988 on Two Forks. Figure 4-3 illustrates how much the mass media had the least interest in the local conflict on Youngwol during the policy agenda setting period before 1997, how much they were indifferent to it even during EIS process and the period of increased local opposition. On the other hand, the Figure shows the least interest on the Two Forks project during the

---

[86] *Chosun Ilbo* (The Chosun Daily News) and *Hankyoreh Sinmun* (The Hankyoreh News) are the representative news media in the contemporary South Korean society (Park 2001; Kim 2001; Jung 2001). The data set is selected from the news articles having the word "*Youngwoldam*" or "*Tonggangdam*" during the policy period (1990 – 2001) in the Korean Integrated News Database System (KINDS) at http://www.kinds.or.kr.

[87] The Denver Post is one of the two major newspapers in the Denver metropolitan area. The data set is selected during the policy period from 1979 to 1990. The news articles having the word "Two Forks Dam" or "Two Forks Reservoir" are collected from *The Denver Post Index* (Bell & Howell Co. Indexing Center. 1979-1986; University Microfilms International 1987-1991). The Denver Post began to provide the news archive since 1993 in its homepage.

policy agenda setting period before 1985. The project began to attract public attention since the end of 1985 when DWB suggested two alternatives and DWB filed a 404 permit on the project.

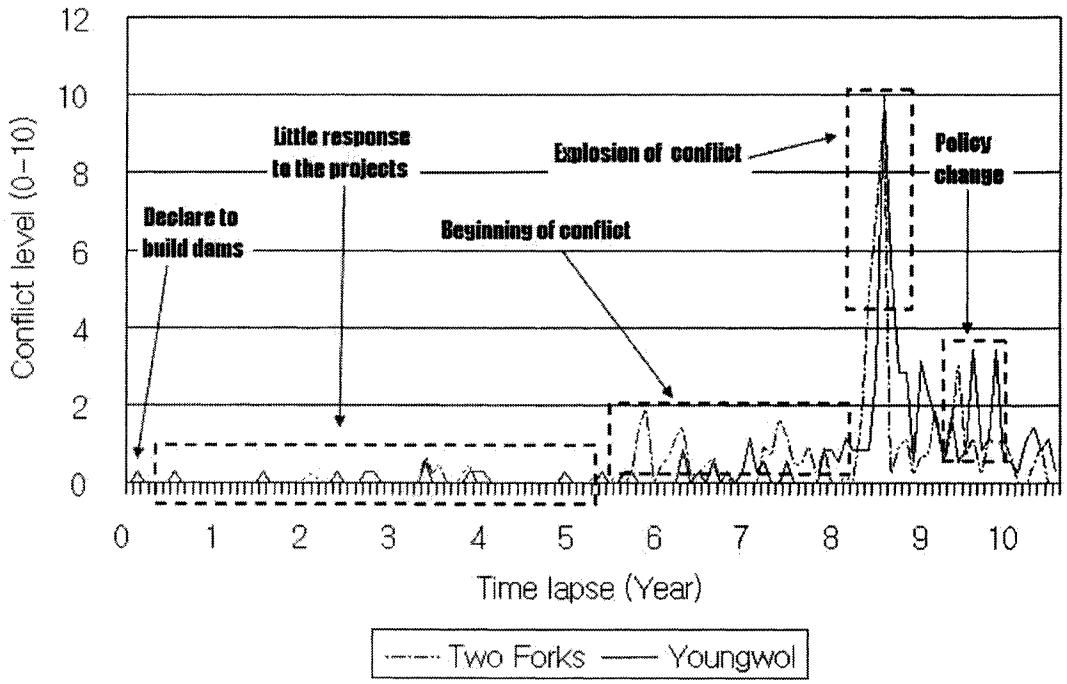

Figure 4-3 Conflict levels on the Youngwol and the Two Forks projects[88]

Both cases showed that the official announcement of dam construction was followed by the period of indifference, the period of hot social issue, and the period of policy change. Those lines of policy making were combinations of a long period of stability and a short period of drastic change as argued by Baumgartner and Jones (1993). As seen in Figure 4-3, the policy eruptions, or explosion of conflict, of the Youngwol and the Two Forks conflicts occurred after at least eight years later since the beginning of the agenda

[88] The two data sets are collected by monthly basis. The two maximum numbers of the newspaper articles are set at the highest conflict level 10.

setting initiated by MOCT of South Korea and DWB of the United States. The apparent policy stability was considered to sustain over long periods of time by "the existing structure of political institutions and the definition of issues processed by those institutions" (Baumgartner and Jones 1993, 15).

However, there was a noticeable difference between the two cases. The water policy actors on the Two Forks project had continuously discussed the effectiveness of the project throughout the whole conflict period. The policy process made incremental progress since the Foothills compromise until the final policy decision-making. The Colorado Governor convened the Roundtable to discuss Colorado water issues even before the DWB's announcement to build the project, COE conducted the NEPA process to review the Systemwide EIS, COE and EPA conducted the CWA process regarding the 404 permit, and finally EPA performed the veto process. Thus the policy process leading to the scrapping of Two Forks had advanced through step by step procedures.

On the other hand, the Youngwol case represented a non-procedural decision-making during the policy process. Each policy coalition stuck to its own position with one-sided allegations all the time. It was nearly impossible to discuss seriously about the issue because each coalition turned a deaf ear to the opposite coalition even during meetings of the Joint Task Force. Thus the policy process made non-incremental progress until the final policy decision-making.

It was the environmental groups, not MOE, who really pushed the President and MOCT to scrap the project. In the beginning of the conflict, MOE could not raise its own

voice against MOCT because of MOCT's dominant political power over MOE[89]. Thus MOE was careful of setting forth a sharply different opinion against the EIS study conducted by KOWACO. The environmental groups were different from MOE in dealing with MOCT. They always strongly blamed MOCT for its water development mind and led the policy process by mobilizing extensive human resources.

4.6. Ripple effects of the regional water conflicts

4.6.1. The Youngwol case

Hye-Jeong Kim[90] maintains that the Youngwol case ushered at least three meaningful paradigm shifts into South Korea: environmentally sound and sustainable development (ESSD), public participation, and inter-generational understanding (Kim 1999). She is proud of the Youngwol case as it becomes the first successful event to recognize ESSD, the first successful participatory democracy in environmental policymaking, and the first successful inter-generational awareness on environmental issues in South Korea.

Professor Oh suggests four important factors in scraping the project: citizens' maturity in the environment, the increased expertise of the Korean civil society, the role of KFEM as the movement center, and the voluntary and bottom-up public participation. He asserts that these extensive social changes justified the environmental movement and brought the loss of government's desire (Oh 2000).

---

[89] MOE became confident of speaking its voice after the environmental groups actively involved in the conflict and MOCT once winced from the strong opposition from them. Therefore, MOE played an important, but not a decisive role in the conflict just like COE did in the Two Forks conflict (see footnote 81 for details).

[90] She is an active woman environmentalist of KFEM. She practically designed and implemented the anti-dam campaign on Youngwol in the late 1990s.

The Korean environmentalists got greatly encouraged with their first successful achievement against the powerful water development organizations - MOCT and KOWACO. On the other hand, the scrapping was a bitter disappointment to the water development coalition who desired the construction of Youngwol Dam. However, the two conflicting interests both agree with the changing water practices that generated by enormous ripple effects of the Youngwol case. I will summarize the emerging water practices into six changes that welcome the new water paradigm in South Korea.

The first change is to admit a new planning mechanism to review public acceptance for the future water projects. The Korean government applies a new institutional framework and the Pre-Environmental Appraisal (Pre-EA) System[91] to resolve future environmental conflicts. The new institutional framework is to set up an ad hoc organization[92] to lead a compromise between conflicting stakeholder interests. The Joint Task Force of the Youngwol case was an excellent example for the new institutional framework.

The second change is to introduce new price mechanisms in water use practice to induce water conservation through applying the tap-water rate actualization program[93] and the three economic instruments[94].

---

[91] It was introduced on August 17, 2000 to improve some institutional limitations of the existing Environmental Impact Assessment (EIA) System. It requires development agencies to discuss with the environmental agency in advance before getting approvals or making decisions on development projects (see section 6.2.1.2).

[92] It is a subcommittee or a task force under an existing government body that executes interdisciplinary studies on the matter. The existing government body makes a final decision based on result of the subcommittee or the task force. This pattern finally becomes a new institutional framework in resolving water and environmental conflicts in South Korea (Lee 2000a).

[93] It aims to increase the tap-water rates to reflect the full production cost until 2004 (see section 6.2.2).

[94] They are the discharge taxation system, the water quality improvement liability system, and the water use liability system (see section 6.2.2).

The third change is to recognize public participation mechanisms to guarantee public acceptance on proposed projects. The Youngwol case was the first successful participatory democracy in the Korean water management. The Korean government enacted the Four Rivers Special Acts (see section 6.3.1.2) since 1999 through improving public involvement methodologies.

The fourth change is to recognize the importance of water governance. It is represented as water structure reforms to transform the existing water management structure into more efficient and effective one. The Presidential Commission on Sustainable Development (PCSD) [95] and the Presidential Committee on Government Innovation and Decentralization (PCGID)[96] of South Korea are involved in the task of improving the Korea water governance.

The fifth change is to recognize the environmental community as a viable policy partner by the government in a water and environmental policy process. The partnership attitude of the Korean government toward the environmentalists has changed, in turn, from anti-government activists[97], through reluctant partners[98], dialogue partners[99] and consulting partners[100], and finally to important policy partners[101] (Lee 2000a).

---

[95] It conducted a research project on water governance from September 2001 to May 2003 with a public hearing on April 8, 2003. It is expected to submit a policy proposal on the Korean water management structure to the President (see section 6.2.4.2).

[96] It is known to reveal a governmental structure reform proposal during 2004.

[97] The Korean environmentalists were intensely suppressed by the military government before the democratic transition in 1987 because they were recognized as anti-government problem-makers. The environmental movement initially emerged as part of democratic movement and part of people's movement. Democratic activists sometimes made use of environmental issues to attract public attentions and to point out misgovernment of the military government (see section 5.2.3).

[98] The environmentalists were remained at the level of distrust and antagonism before the adventure of a genuine civilian President Kim Young-Sam administration in 1993.

Table 4-10 Relationships between the government and the environmentalists

Period / president	Office term	Power balance	Partnership with NGOs	Attitude of gov't toward NGOs
Before 1987	-	No relationship	Anti-government activist	Hostility
Noh Tae-Woo	1988-1992	G >> E	Reluctant partner	Unconcern
Kim Young-Sam	1993-1997	G > E	Dialogue partner	A nuisance
Kim Dae-Jung	1998-2002	G = E	Consulting partner	Advisory partner
After Youngwol	Since 2000	G < E	Important policy partner	Power entity

Note: G- the government, E: the environmentalists

The sixth change is to recognize the environmental values of water and river. Based on the Section 2 (12) of the *Natural Environment Conservation Act*, 65 ㎢ area along 46 km stream of the Tong River basin in Kangwon Province was designated as a National Conservation Area[102] on 9 August 2002[103].

---

[99] It was not until the civilian government that governmental officials formally began to talk with the environmentalists. The establishment of KFEM in 1993 was a symbolic event for environmental community in South Korea to get out of pro-democracy people's movements focusing on political struggle into pro-environment citizens' movements focusing on environmental conservation campaign (see section 5.2.3).

[100] When the Kim Dae-Jung administration took the political power in 1998, the environmental community was treated nearly equivalent to the level of the new government because the democratic activists including environmentalist had greatly helped the president during his hard time as a pro-democratic fighter before 1987.

[101] The environmentalists enjoy a dominant power on water policy process for their winning position in the Youngwol battle over the government (MOCT).

[102] Most of the anti-environment activities including cooking, camping, gathering plants, hunting animals, cutting down trees, and constructing new buildings will be

4.6.2. The Two Forks case

The veto of the Two Forks project was a great victory to the environmental coalition and downstream communities while it was considered a calamity for water developers and Denver communities. It also marked the advent of a new age in the United States as the federal EPA had never dropped a veto once a process had been started before the Two Forks conflict. The demise of Two Forks initially shocked the Denver community including DWB and MWP. Then it served as a momentum in fundamentally rethinking the state water management strategy from water development toward water conservation. Thus it consequently heavily contributed to welcome a new water paradigm that led to some important changes in managing water resources in Colorado.

In the first, the veto showed the West the declining role of the Prior Appropriation Doctrine[104] superseded by waxing power of environmental laws[105] (Zaslowsky 2000, 208). The veto made not just dooming a dam but undermining the powerful authorities of DWB and other water agencies and the role of the doctrine in the West[106].

---

prohibited inside mountainous regions. And land development projects will require prior authorizations from the government.

[103] http://wonju.me.go.kr/future/subtitle/2sb_a06.shtml (in Korean).

[104] The doctrine began with a rejection of the riparian doctrine in the nation by the case of *Irwin v. Phillips* (Supreme Court of California, 1885) (Gould and Grant 1995, 15-20). The state of Colorado adopted the doctrine in 1882 by *Coffin v. Left Hand Ditch* (Supreme Court of Colorado, 1882) instead of riparian water rights (ibid. 84-9).

[105] The water demand along the Front Range had usually been met by building dams and water facilities on both sides of the Continental Divide before the 1970s when major environmental laws came into effect. Since then, newly established environmental regulations hindered the development of these types of water supply projects.

[106] The doctrine has been, until now, the unique water law and has become the most powerful determinant in guiding the order or pace of western water development. Since its establishment in 1918, DWB had made full use of the doctrine in securing water of

The second change is the shifted status of DWB as it becomes no longer the leading and primary agency to supply water for the suburbs by getting extra water from the West Slope[107] (Ellison 1993, 128)[108]. DWB also changed its logo[109] and human resources[110] and adopted a completely different water paradigm.

The third and most important change is the shifted water policy in Denver and also Colorado. The DWD manager Hamlet J. Barry[111] who was appointed in January 1991 and is still in service as of October 2003, adopted the new water paradigm saying that, "beliefs that belong to the environmental fringe in the 1960s have become mainstream values today" when he visited the west slope in late August 1991. He also appended that the DWD's old ideology had changed with completely different ideas from the past[112] (Marston 2000, 215-6).

---

both sides of the Continental Divide and was never defeated in developing and transferring water to the Denver metropolitan area before the Two Forks case.

[107] In the past, DWB went to West Slope to get water as much as necessary whenever Denver needed water. Now, DWB no longer get water without approval of West Slope (Hinchman 2000a, 204).

[108] According to the DWB's policy statement released two years later the veto, "Denver's Water Board may no longer serve a central planning role for water supply under current institutional and political constraints. ··· the Water Board is preparing for a different role in metropolitan water supply and development" (Maddaus 2001, 297).

[109] DWB and its executive body Denver Water Department (DWD) amalgamated their logos into Denver Water (Denver Charter, Article X, §10.1.6) to avoid confusion between the terms DWB and DWD by eliminating the words Board and Department (Ellison 1993, 61). Despite of its new logo, the inside structure of Denver Water still keeps to past customs. It continues the divided function between a board of directors (DWB) and DWD.

[110] DWB replaced itself with new members and appointed a new manager of DWD.

[111] He was ex-executive director of the Colorado Department of Natural Resources, dealing with water, mining, parks, wildlife, and geology. He also has served as a practicing lawyer, manager and administrator in the natural resources field since 1969. Considering his career, he seems to have balanced knowledge on water development and conservation; http://www.denverwater.org/whoweare/whoweareframe.html.

[112] It recalls us the Kuhn's definition of the new paradigm, "the reconstruction of prior theory and the re-evaluation of prior fact" (Kuhn 1970, 7); see section 2.2.

Two of the most important policy changes of DWB are adoptions of Integrated Resources Planning (IRP)[113] and water conservation programs[114]. In June 1992, DWB announced to suspend work on Two Forks, but it did not mean abandonment of seeking new water sources. DWB adopted demand-side water management including water exchanges and small expansions of existing facilities, instead of pursuing supply-side water management (Ellison 1993, 129). DWB adopted the original IRP[115] and later the formal IRP[116] as a new water policy to achieve such shifted policy goal.

---

[113] IRP is a relatively new concept with inclusive thus no broadly accepted meaning. It depends on the premise that "a wide range of traditional and innovative supply-side and demand-side (conservation) resources must be considered" to lead a better long-term decision (AWWA 1994, '1-1'-'1-2'). AWWA defines IRP as "a continuous process that results in the development of a comprehensive water resources management plan" (Maddaus 2001, 264).

[114] It included taps allocation and water rate increase in out-city, restrictions on new service areas, universal metering, and cash rebate for water-saving toilets. DWB's distributors, especially MWP, initially felt absurd and soon were enraged at DWB's actions because they hoped to keep their partnership with DWB despite the Two Forks veto. They criticized DWB of its selfish 'Jekyll and Hyde' attitude, approaching with smile when necessary but then breaking up the promise of regional cooperation in adverse condition (Ellison 1993, 126).

[115] The original IRP process was executed with extensive public participation for two years from 1994 to 1996. The result of it shed light on the Board Resource Statement released on 15 October 1996, which articulated the newly defined role of DWB in water resources planning and management in the Denver metropolitan area. The demand management policy led by complete stakeholder involvement process was one of prerequisites to ensure a successful transition from the Two Forks era to a new vision of the paradigm shift (DWB 2002, 65).

[116] In 1994, DWB formally entered on a three-year IRP initiated from the shifted role in regional water management. The new IRP was completely different from the previous water management strategy focusing on a single project. DWB developed about 200 water supply options through extensive supply-side and demand-side analysis including structural and non-structural alternatives. DWB also included extensive components of both conservation and public participation in the IRP (Maddaus 2001, 297-8). Even in 1997, DWB showed a very rational attitude toward Two Fork by admitting the EPA's veto as an almost inevitable decision from the perspective of 1997 (DWB 1997).

4.7. Concluding remarks

The Two Forks and the Youngwol projects had a number of similarities and differences. Each needed nearly nine years to reach final decisionmaking after announcement of dam construction. Despite water developers' intentions to meet utilitarian needs, they were faced with widespread environmental opposition. The decision-makings on the two projects appears at first glance to be made under formal institutional frameworks, but in actuality, they relied significantly on decisions of the two important political actors.

The Youngwol case was actually a battle between the government (MOCT) and the civil society (mainly environmental groups) while the Two Forks case was between the regional water agency (DWB) and the federal government agency (EPA). The environmentalists were important but not leading policy actors in the Two Forks policy process. The two cases consisted of a long period of stability and a short period of drastic change respectively. But the Youngwol case saw dominant powerful rushes of environmental groups against the government, thus the actual decision was a non-procedural decision made by the presidential opinion regarding the upcoming general election. On the other hand, the Two Forks case was an incremental procedural decision made by step-by-step institutional processes since the early 1980s. The similarities and differences of the two cases are compared in Table 4-11.

Thus the success possibilities of the two projects were quite different each other. The chance of successful construction of Youngwol Dam drastically declined since the environmental groups began to intervene in the dispute. The President wanted to reach a compromise on the battle before the general election considering its political importance

for the ruling party. Some commentators point out that the activity of the Joint Task Force was nothing but a follow-up process to justify the prior presidential remark.

Table 4-11 Similarities and differences between Youngwol and Two Forks projects

Item		Differences	Similarities
Motive	YW	Water supply + flood control	Development mind (anthropocentrism)
	TF	Water supply	
Principal dispute body	YW	MOCT vs. Environmentalists	Development coalition vs. environmental coalition
	TF	DWB vs. EPA	
Permit process	YW	Rough (Dam Act)	Statutory provision
	TF	Specific (NEPA, CWA)	
Environmental groups	YW	Leading policy actor & combative	Active involvement
	TF	Not leading & moderate	
Spatial coverage	YW	Nationwide anti-dam movement	Huge attention across the country
	TF	Basically state matter	
Residents relocation	YW	Relocation was a hot issue	Local residents to be relocated
	TF	Relocation was not a hot issue	
Water transfer	YW	Not a big issue	Transboundary issue
	TF	Huge opposition from West Slope	
Policy process	YW	Non-procedural decision	Long period of stability & short period of drastic change
	TF	Procedural decision	
Real decision	YW	Kim Dae-Jung (President)	Political decision, but rely on personal sentiment
	TF	Mr. Reilly (EPA Administrator)	
Formal decision	YW	By review of the Joint Task Force	Cancel (biocentrism)
	TF	By EPA veto on CWA 404 permit	
Ripple effect to developer	YW	Still in supply-side policy	Significant effect on water policy
	TF	Move towards demand-side policy	

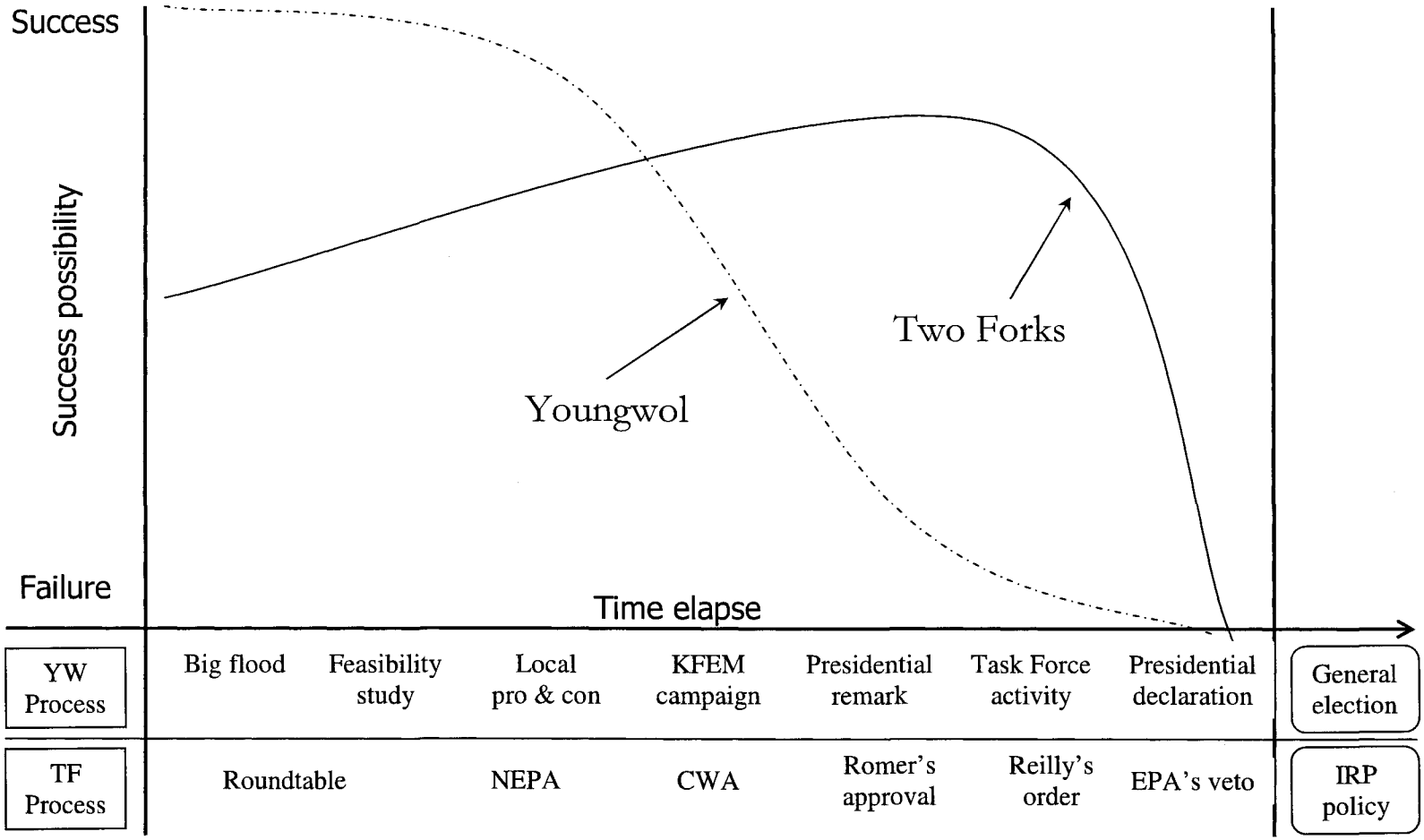

Figure 4-4 Success possibilities of Youngwol and Two Forks dams

The case of Two Forks depicted a very different pattern from that of the Youngwol case. No one expected this dramatic turning before William Reilly decided to order his Denver office to begin a veto process. Hinchman (2000a, 203) said that both sides of environmentalists and water developers were astonished at the news from Washington. Leaders of Denver communities were also shocked at the unexpected event. Zaslowsky (2000, 208) also described William Reilly's decision as unthinkable. Thus, the chance of success to construct Two Fork Dam had increased until the decision of William Reilly and suddenly dropped after that time.

5. Driving forces for the new paradigm in South Korea

5.1. Purpose of chapter

Dramatic political and social changes in South Korea since World War II have led to the new paradigm for IWRM, as they have in other national institutions. Most of the infrastructure was destroyed during the Korean War from 1950 to 1953. The gloomy atmosphere and persistent poverty after the war led to a military coup d'etat in 1961. Although the coup deprived the Korean people of democracy, it led to economic development followed by political and social changes.

The economic initiatives resulted in rapid industrialization during the 1960s and the 1970s, and as a result the middle class and civil society grew rapidly. These changes forced political liberalization during 1980s, and greater democracy during the 1990s. These created a favorable climate for environmental groups. The new water paradigm resulted from all of these changes.

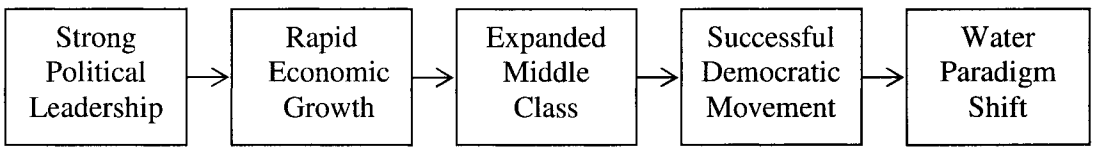

Figure 5-1 Evolutionary process to the new water paradigm in South Korea

In this chapter, I will identify five driving forces that led to the new water paradigm: economic, political, social, environmental, and technological aspects. In addition, how they influenced on the Korean water policy will be discussed later.

5.2. Major elements of the driving forces

5.2.1. Economic element

Environmental protection appears to be related with economic growth because the former can be implemented at the expense of the latter (Karshenas 1994). The relationship between them is considered to be a complementary[117]. Thus, high income and technological progress caused by economic development can provide more effective and diverse means for water policy makers. A strong and diverse national economy is apt to admit the new water paradigm by adopting tough water regulations and pricing policies (Karshenas 1994; Allan 2001, 146).

Increased economic outcome of a country encourages environmental conservation to protect natural resources. The World Bank analyzed the connection between per capita income and environmental quality in *The World Development Report* of 1992 (World Bank 1992). The relationship is referred to as the environmental Kuznets curve after Kuznets (1955)[118].

Meyer et al. (2003) examine the effects of economic, institutional and social capital variables on deforestation across 117 countries and show a correlation between income (per person per year) based on purchasing power parity[119] and protection of forests

[117] The relationships look like trade-offs or complements in developed nations, but environmental degradation comes from economic stagnation in many developing economies (Karshenas 1994, 743); http://www.wsu.edu/~susdev/Karshenas94.html.

[118] His original theory explains the relationship between income and inequality. Dietz and Adger (2001), however, maintain that the environmental Kuznets curve is useful to explain the relationship between economic development and environmental quality.

[119] The basis of purchasing power parity (PPP) is the law of one price. It expresses the price of an identical good be the same in two countries considering no transaction costs.

(deforestation rate). This relationship can be extended to other environmental indicators like water quality area.

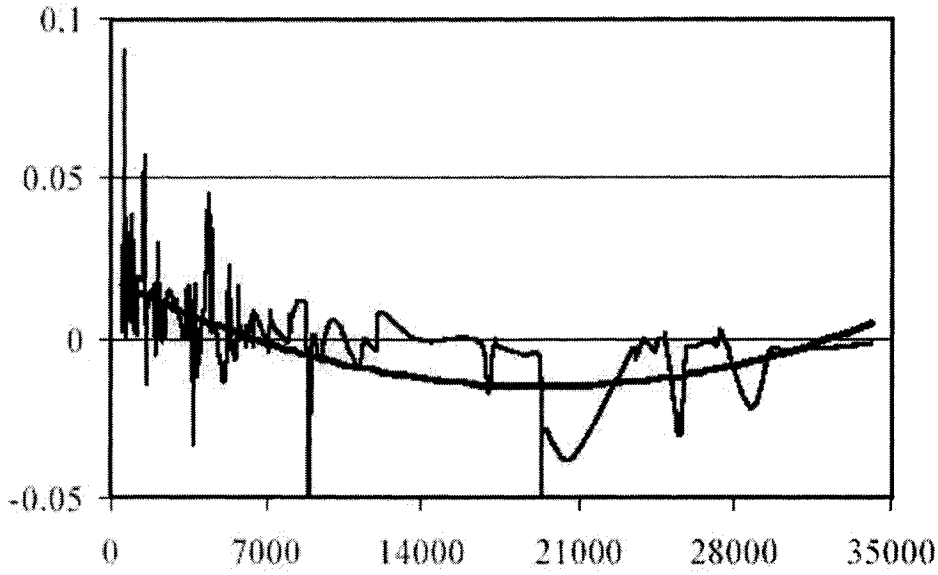

Figure 5-2 The environmetnal Kuznet curve (Meyer et al. 2003)

During the past four decades, South Korea shifted from poverty to a middle-level economic power (Jwa 2001). The nation has become one of the most competitive in the world in steel, shipbuilding, automobile, and electronic industries. This economic growth spurred political democracy as well. Considering the concept of the Kuznets curve suggested by Mayer et al. (2003) and the Karshenas theory (1994), South Korea is tending to protect its resources more than in the past.

Table 5-1 Per capita PPP GNI of selected countries in 2001

Country	GNI ($ billion)	Per capita GNI ($)	Per capita PPP GNI ($)
United States	9,781	34,280	34,280
Japan	4,523	35,610	25,550
France	1,381	22,730	24,080
Spain	588	14,300	19,860
South Korea	448	9,460	15,060
Argentina	260	6,940	10,980

Source: Selected from Bank of Korea (2003, 333-4).

5.2.2. Political element

Political driving forces are important because public participation and governmental accountability affect water and environmental management. Democracy improves environmental protection and commitment regardless of level of income[120]. The role of the media is also important in improving accountability and reducing the incentives of government corruption (World Bank 2003, 41).

South Korea has experienced dramatic political changes since the early 1960s[121]. South Korea's greater affluent society and public awareness gave rise to a rapid expansion of

[120] Two plausible arguments explain that democracy generally encourages environmental protection and economic efficiency. First, democracy helps deviation from concentrated benefits and recognizance of dispersed interests. Secondly, freedom of expression and association contributes society or government to select the most compromising alternative and to adjust to change (World Bank 2003, 46).

[121] It was a series of the military coup in 1961, following military regimes until 1993, the successful democratic transition in 1987, the period of democratic consolidation from

the middle class (Oh 1999, 5) or "the ongoing process of embourgeoisement" (Chan 2000, 187) since the mid-1970s. Kim-Sunhyuk (2000, 115-7) identified three important positive changes[122] in South Korea since 1987: fairer and more extensive political competition, expanded civil liberties, and civilian control over military. South Korea seems to have successfully transformed into a trade-off stage between democratic transition and social stability.

The military and the *chaebols*[123] were two most powerful political and economic entities respectively in South Korea until 1980s (Oh 1999, 210). However, they began to lose their vested powers since 1990s: the military after the emergence of civil government in 1992 and the *chaebols* after the IMF bailout in 1997 along with the development of the civil society.

All of the above political changes transformed the Korean water "policy network"[124] (Bressers et al. 1995, 199-202) from a closed "policy curtain"[125] until 1960s or "iron duet"[126] (Yishai 1992) until 1980s to an open "issue network"[127] (Heclo 1978) since the

---

1988 to 1992, the new civil government in 1993, the first-time transfer of power to the opposite party in 1998, and the progressive government of social minority in 2003.

[122] He also mentions the persistence of negative images of old legacies including elitism and corruption.

[123] They are large business groups or conglomerates of many companies clustered around one holding company like Samsung, Hyundai, LG, and SK. They have become powerful entities since 1980s to be a burden to the Korean economy policy.

[124] Policy network means "the large class of multi-actor arrangement of interdependence" in the policy process (Bressers et al. 1995, 5).

[125] It portrays a monopolized policy process by excluding of outside participation (Yishai 1992, 94-5).

[126] It is a typical policy process of technocratic politics by enjoying "unchallenged alliance between the state and the experts" (Yishai 1992, 96).

[127] It was coined in the United States in the late 1970s as the opposite concept of the iron triangle. It depicts a policy process of no entrance barrier, thus it "comprises a large number of participants" (Heclo 1978, 102) and do not exclude latent stakeholders' involvement.

mid-1990s. The networked Korean society enables public involvement in the water policy sector as the government removes the reins from political opponents. Thus, the political driving forces accelerate public participation and governmental accountability[128].

5.2.3. Social element

Economic growth also expanded the higher education system and increased industrial capacity. South Korea has more college students per capita[129] and more newspaper readers per capita than almost any country in the world (Cumings 2000, 140). These factors increasingly contributed to challenge undemocratic governmental discretions and military-dominant governance.

A large number of college students became pro-democracy activists during the military rule. The student movements were concurrently political, social, and cultural movements[130] that changed the Korean society towards democracy (Koo 2001, 18). After a long period of political instability, many pro-democracy activists emerged and finally, in the late 1980s, student power was considered to be the second important political power next to the military in the Korean society (Lee 2002, 132). Since the 1987 democratic transition, some of pro-democracy activists returned to their normal lives and

---

[128] Taiwan shares very similar experiences of economic modernization and political democracy with South Korea. Different from successful public participation in South Korea, however, Taiwan is still under the dominant influence of economically privileged groups and sees insufficient public participation in water policy process (Hsu 2004, 68).

[129] According to the 1998 statistical yearbook of UNESCO, the number of college student per ten thousand of population was 495 in South Korea. It was more than Germany (264), Japan (314), United Kingdom (313), but less than United States (540); http://www.kcue.or.kr/univ_paper/paper_read.asp?num=2731&tp=04 (in Korean).

[130] For example, many student activists voluntarily became students-turned-workers to fight against the military regime. They went to factories to organize labor forces by concealing their higher educational backgrounds.

others devoted the efforts to the environment movement[131]. Especially, the 1990s saw a great transformation of student power and anti-government activists from people (social protest) to citizen (citizens' movement) (Lee 2002, 156).

Furthermore, since the 1990s, the civilian presidents have filled some of their cabinets with "progressive outsiders" or reform-oriented politicians (Oh 1999, 131) who were anti-government activists or students-turned-workers during the military dominance. Some pro-democracy activists became leaders of the civil society organizations and others entered into the political circles to be members of the National Assembly[132], presidential secretaries, or political high-ranking officials. Therefore, it is natural for them to share like-minded opinions together at some policy issues including environmental matters.

The United States experienced a great social change in the 1960s that marked the beginning of the post-industrial era in the country (Wilds 1988, 1). The similar story occurred in South Korea in the 1990s when a new set of public attitudes on environment gave rise to national environmental movements. The enhanced environmental awareness triggered a series of water policy reforms in the next decade. The 1960s in the United States and the 1990s in South Korea signify the arrivals of reflexive modernity (Beck 1992, 3) at these two countries respectively.

---

[131] The Korean Federation of Environmental Movement (KFEM) served as the principal body in scrapping the Youngwol project (see section 4.3.2). Its head Yul Choi was a former student activist. He arrested twice and spent 5 years in prison until 1981 for his anti-government activities and later formed the first environmental group, the former KFEM, in South Korea in 1982 (Shin 2004).

[132] As a result of the general election on 15 April 2004, many former student and labor activists during the military domination become members of the National Assembly (22% or 67 out of 299); "Undongkwon chulsin 22% (22% comes from student and labor movement activists)," *JoongAng Ilbo* (The JoongAng Daily), Internet edition, (Seoul, South Korea), 26 April 2004.

Economic growth and political democracy led to social change in South Korea. The emergence of the middle class pushed the political structure from authoritarian to liberal democracy. In addition, the burgeoning civil and democratic society shifted the environmental attitudes of the Korean public toward more participation and greater accountability.

5.2.4. Environmental element

The environmental condition of South Korea worsened during the 1960s and the 1970s when the nation achieved the most noticeable economic miracle in the world. As a result, the Korean people became more sensitive about environmental degradation and their attitudes have moved towards environmental conservation since the 1980s.

The Korean people were influenced from international trends and domestic environmental episodes. Three events are worthy of mention: the UNCED conference, the water quality accidents of the Nakdong River in the early 1990s, and the Youngwol conflict in the late 1990s. The two domestic water events became "emblematic issues" (Hajer 1995, 265) or "emblematic events" [133] (Allan 2001, 328-9) to reconsider the environmental values in formulating the Korean water policies. As explains in section 6.2.4, the Nagdong accidents moved the Prime Minister to make an important decision on the Korean water governance in 1994 and the Youngwol conflict forced the Korean government to adopt the demand-side water management in the 2000s.

According to a public survey on environmental consciousness (Koo 1999; MOE 2003b), more than 90% of the Korean people have worried about environmental

[133] Extreme environmental events can easily put environmental issues on the political agenda because they attract public and media attentions (Allan 2001, 328).

degradation since the 1970s, especially after the early 1980s. With concerns about environmental degradation, at least four out of ten has not agreed with governmental environmental policies. The Korean people showed the highest concerns towards environmental situation and the lowest trust about environmental policy in 2000. This may be derived from the ripple effect of the Youngwol conflicts in the late 1990s.

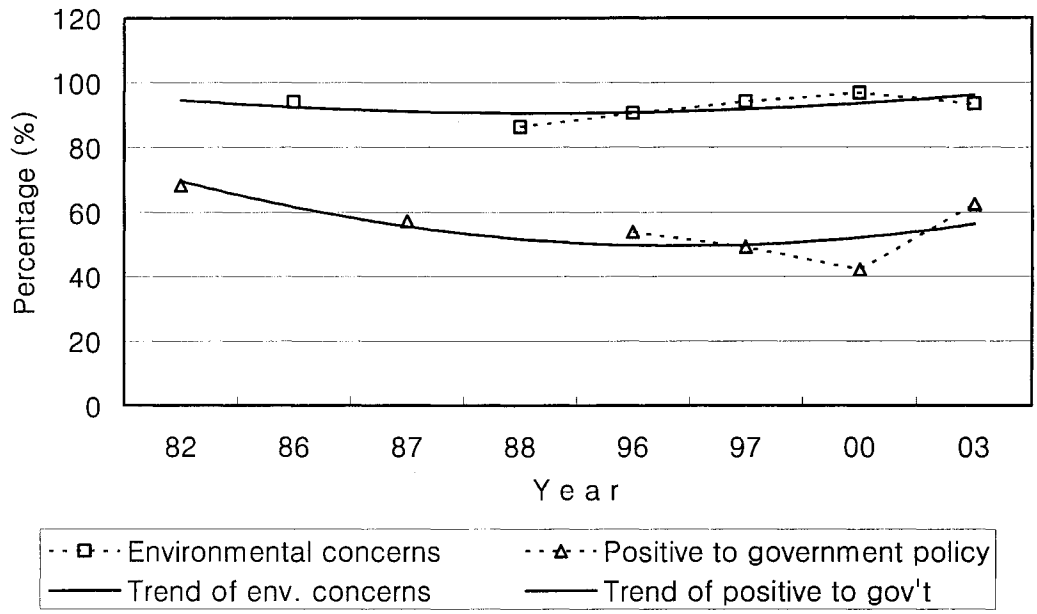

Figure 5-3 Environmental consciousness of the Korean people[134]

The increased public awareness on the environment pushed the government to adopt more stringent environmental statutes. The development statutes prospered during the 1960s while most of the major conservation statutes were enacted since the 1990s, like those of the United States in the 1970s.

[134] The survey data comes from Koo (1999) until 1997 and MOE (2003b) from 2000.

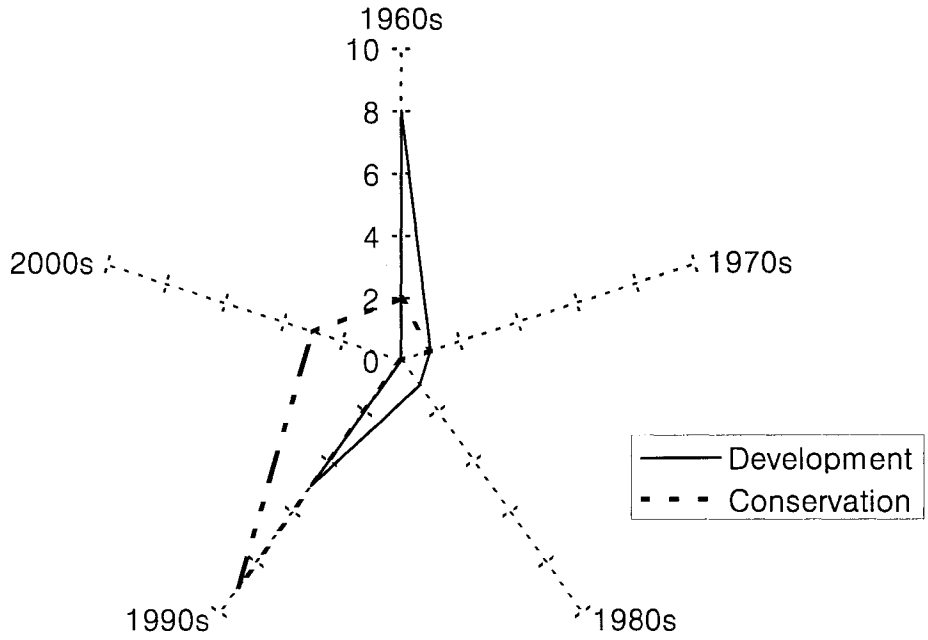

Figure 5-4 Number of major water-related legislations in South Korea

South Korea has experienced increased public consciousness towards conservation since the 1980s and intensified regulations since the 1990s. Now, Korean water management should adapt to the new environmental attitudes of the Korean society.

5.2.5. Technological element

The technological change is recognized as one of the significant factors to achieve environmental protection at the low expense of economic growth (Karshenas 1994, 747). In this dissertation, however, I will concentrate on the Internet democracy generated by rapid development of information technology (IT) to discuss the dynamic driving forces of the new water paradigm in South Korea.

The technological element can be explained by the advancements of IT and the Internet (Alexander and Pal 1998, x ii, 1). Accessibility to information has become one of the most important elements for measuring the level of participatory democracy (Hornby and Clarke 2003, 133).

Table 5-2 Different societies before and after the IT innovation

	Industrial society	Information society
Society	science & technology society	knowledge society
Population	movement of population	dispersal of population
Labors	movement of labor between sectors	post-industrial jobs and sectors
Work	new pattern of work	flexible modes of work
Mainstream	well-trained workers	Experts
Market	specialized for wide markets	customized for wider markets
Capital	intensive use of capital resources	extensive capital investment in IT

Source: Summarized from Hornby and Clarke (2003, 27-8).

South Korea's development and use of IT has grown tremendously since the mid 1990s. About 30% of the total export amount in 2003 came from the IT industry[135]. The Internet infrastructure and the rapid increase of Internet users gave South Korea an Internet democracy[136].

[135] South Korea exported nearly $200 billion in 2003, all of the major export items of which are the high-tech and the heavy industry commodities including semi-conductor, automobile, cellular phone, computer, and ship.

[136] The Internet exercised significant influence on governmental policy decisions, especially to the Youngwol conflict in late 1990s and to the presidential election in the late 2002. KFEM successfully mobilized the anti-dam campaign using its websites. It became clear in the presidential election campaign that the traditional mass media

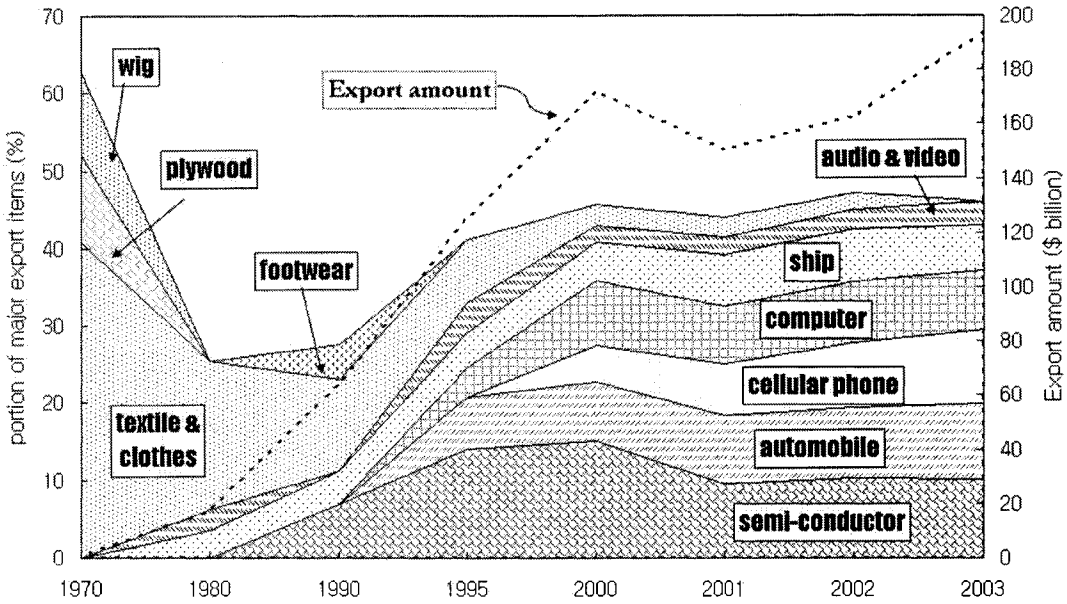

Figure 5-5 Total export amount and major export items of South Korea[137]

For examples, 64.1%[138] of the Korean people were connected to the Internet with 23.2% of high-speed connection at home or office by June 2003. Until April 2001, the Korean government completed to distribute PCs for free of charge to all school teachers (34,854 persons) and all k-12 classrooms (222,146 classrooms in 10,064 schools). In addition, every classroom is equipped with more than one computer with Internet connection, a computer project, and a big projection TV[139]. Thus anyone who has his

---

including newspapers, radio, and TV, which are capital-intensive and off-line, was completely overwhelmed with the new Internet media, which is information-intensive and on-line. Thus the Internet realized the real participatory democracy in South Korea.

[137] Two data sources: 1) 1995-2003 from MOCIE (2004), 2) until 1990 from http://sei.knu.ac.kr/ysoh/etext/html/512.html.

[138] It was 28.6 million out of 47.8 million, thus nearly all of the Korean people, except the young kids and the older, can access to the Internet. It means one of the highest numbers in the world.

[139] "Jeonkuk chojungko gyosil internet yunkyul wanryo (Completion of Internet connection to every k-12 classrooms)," *The Korea Economy Daily*, Internet edition, (Seoul, South Korea), 20 April 2001.

opinion to a specific policy matter can participate into the policy formation process at anytime and anywhere.

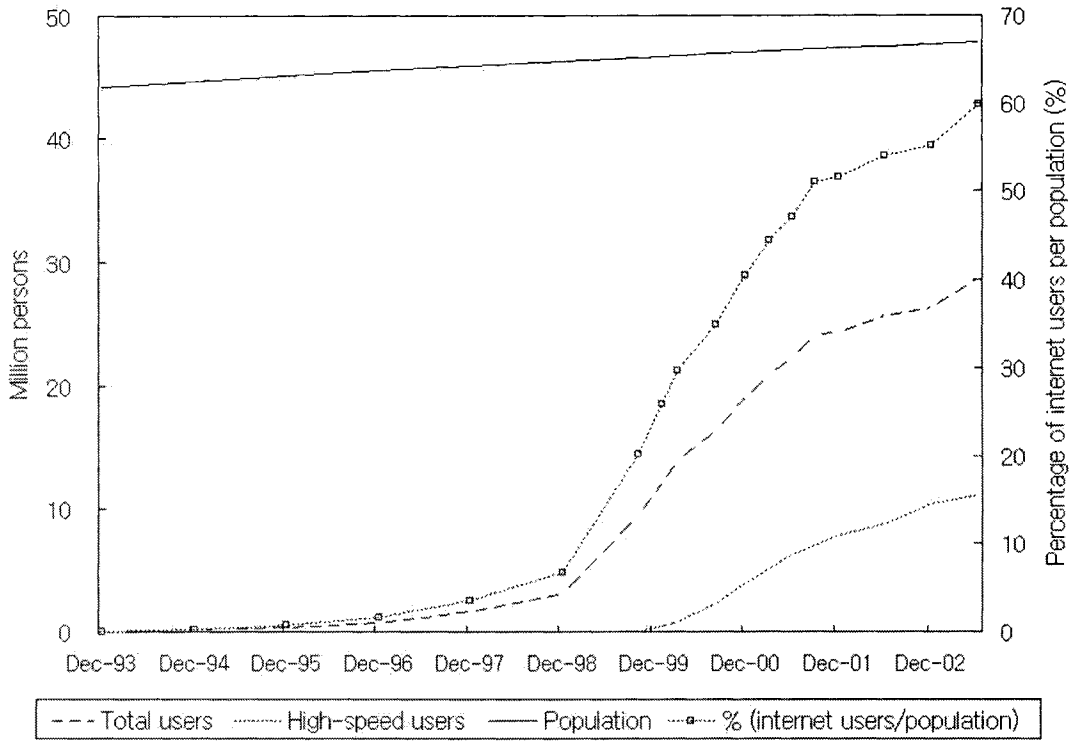

Figure 5-6 Internet users in South Korea[140]

Such highly networked society attracts much attention from international community. South Korea has been recognized as the most Internetized and digitalized country in the world since the end of the 1990s. *The New York Times* reports that the Internet and broadband connection are "part of the culture" for South Korean people[141] and "Korea

[140] The internet user data comes from the Network Statistics Information Center operating by the Korea Network Information Center; http://isis.nic.or.kr/sub04/sub04_index.html?sub=01V&id=522.

[141] "In Korea, broadband is part of the culture," *The New York Times*, Internet edition, 29 October 2001.

has highlighted how far the United States has to go."[142] *The Guardian* refers to the case of South Korea as a miracle by stating "South Korea has shown the world what the broadband future looks like."[143]

The Financial Times identifies that "more than one in two South Korean internet users enjoy broadband connections" and "South Korea has leapt ahead of western economies, ··· the US to be the second-most developed broadband market" behind South Korea[144]. *The Guardian* speaks of the current Korean president as "world's first internet president" by reporting "South Korea will stake a claim to be the most advanced online democracy on the planet."[145] A French daily newspaper *LeMonde* refers to South Korea as "the country of digital democracy"[146] in its Internet edition on April 14, 2004.

Highly sophisticated digital industry and widely developed Internet technology, coupled with political and social changes, led the Korean society to the post-industrial society and reflexive modernity (Beck 1992). The participatory democracy of South Korea has greatly increased and it forced the Korean government to adopt more open and bottom-up policy processes. As a result, it also contributed the Korean water policy to move towards the new paradigm.

---

[142] "America's broadband dream is alive in Korea," *The New York Times*, Internet edition, 5 May 2003.

[143] "Miracle workers," *The Guardian*, Internet edition, 17 October 2002.

[144] "Britain languishes in broadband league table," *The Financial Times*, Internet edition, 3 April 2001.

[145] "World's first internet president logs on," *The Guardian*, Internet edition, 24 February 2003.

[146] "Hankook eun digital minju jueui eui nara (South Korea is a digital democratic country)," *OhMyNews*, Internet edition (Seoul, South Korea), 17 April 2004.

5.3. From driving forces to water policy reforms

Economic development is not a sufficient but a necessary factor to induce water reforms (Turton 1999, 29). Economic change in South Korea provided an opening for political democracy and new environmental values. Political change accelerated public participation and governmental accountability. Social change also encouraged public participation and governmental accountability by providing diversified perspectives in Korean society. Environmental change increased public consciousness towards environment conservation since the 1980s and intensified environmental regulations later. The political power of South Korea has shifted from hard power to soft power: military to economy during the industrial period and from economy to knowledge during the information period generated by the IT (Kim 2004, 340). Technological change promoted by the Internet and networked society contributed to participatory democracy in the water policy process. The IT led the Korean politics from government to governance (ibid. 338)[147].

South Korea's international involvement is also a factor. It was invited to join the Organization for Economic Cooperation and Development (OECD) in December 1996. This opening and greater affluence allows the Korean people to reconsider environmental values and move towards the new water paradigm.

The socio-economic development enabled the Korean government to adopt more effective and diverse government policies and thus improved the national environment as suggested by the theories of Kuznets (1955) and Karshenas (1994). The political

[147] It does not say that government is displaced by governance but that the water policy process is transforming from government's 'command and control' style to governance's 'government as enabler' style (see section 2.3.3).

democracy and the environmental awareness encouraged public involvement through transforming stakeholder interests "from outsiders to insiders" (Bulkeley 2003, 144). The extreme water quality accidents in Nakdong River contributed to bring about the emblematic effects (Hajer 1996) on the Korean water policy.

According to the OECD (1989, 49-50), environmental crisis – pollution spill, drought, or external stimulus - is identified as the most influential trigger factor leading to effective integration of water resources management. It sometimes becomes emblematic effect if it is a severe event or accident. The second factor is interest group pressure, but it is usually combined with the third factor of new research and data. The remaining factors, including the planning process change, the political change, the government's administrative reorganization and the macro-economic change, are recognized as less influential forces in water management practices. Thus, national water policies are generally apt to change if environmental groups effectively utilize the emblematic effects of severe water accidents.

Table 5-3 Major trigger factors leading to IWRM in OECD countries

Factor	Environmental crises	Interest group pressure	New research or data	Planning process change	Political change
Frequency	54	48	35	34	32
Effect	20%	18%	13%	12%	12%

Note: 1. Minor trigger factors are government structure reform (21; 8%), staff change (18; 7%), macro-economic change (9; 3%), others (20; 7%).
2. Frequency indicates the number of responses from experts of OECD countries.
Source: Summarized and revised from OECD (1989, 56: Table 5).

Extreme water events induced the Korean public to reconsider the existing water management practices, thus politicians and environmentalists are apt to change their prevailing beliefs. A "window of opportunity" (Kingdon 1984, 173-9) waits for instable situations to open its window, thus timing is extremely important to open a policy window for water sector reform (Turton 1999, 18). The driving forces for the new paradigm in South Korea became stronger and bigger since the 1960s and were ready to explode until the 1990s. Rhee and Jeong (2003) assert that the emblematic effects in the beginning 1990s triggered to open a policy window since the late 1990s in case of the Korean water management.

For examples, the water governance debates since 1990s (see section 6.2.4) and a series of governmental efforts in the 2000s (see section 6.3.1) are considered to be resulting outputs of the opened policy window. Even though the water quality accidents became the direct causes of the water policy reforms since the mid 1990s, the new water paradigm could not emerge in South Korea without combined thrusts of economic, political, social, environmental, and technological driving forces in the background.

5.4. Concluding remarks

The new water paradigm in South Korea is not occurring by chance. The successive streams of economic, political, social, environmental, and technological changes have greatly affected Korean water management as the government power was confronted with strong environmental challenges in the Youngwol conflict. As a result, the old water development ideology will be completely replaced with the new paradigms of ecocentrism in the near future.

Challenged with changed civil society and public environmental attitudes, South Korea still needs new water infrastructures but requires new policy approaches and planning and decision making mechanisms to adapt to the paradigm shift from the supply-side water development towards the demand-side water management.

This chapter discussed the driving forces that led South Korea to the new water paradigm. Chapter 6 will discuss the new water paradigm in South Korea by focusing on planning, pricing, public participation, and water governance. In addition, I will discuss three changed water management practices in South Korea. They are the comprehensive water management measures and the Four Rivers Special Acts initiated by the active government efforts, and a local watershed movement voluntarily achieved by active participation of local residents.

6. The new water management paradigm in Korea

6.1. Purpose of chapter

This chapter explains the new water paradigm in South Korea that was discussed in the frameworks of its global perspective in chapter 2, national water management and policy in chapter 3, and local water conflicts in chapter 4. These chapters reviewed systematic perspectives of the new water paradigm at the international, national, local levels. In addition, chapter 5 reviewed the five driving forces enabling the paradigm shift in South Korea with reference to the economic, political, social, environmental, and technological aspects. In this way, coupled with the previous chapters 2, 3, 4, and 5, this chapter leads the reader to understand the emerging new paradigm in managing the South Korean water resources.

Chapter 2 proposed IWRM as a sustainable approach to Korean water management and transformed the IWRM components in Chapter 18 of Agenda 21 into four principal elements to discuss the new water paradigm in South Korea. The global perspectives of the new water paradigm will be combined with the practical IWRM applications to understand the new water policies in South Korea.

In this chapter, I will discuss the four elements (explained in section 2.6 and Table 2-7) in more detail in the perspective of their applications by the government and local community. Active government efforts (the comprehensive water management measures and the Four Rivers Special Acts) and a voluntary watershed movement (the Daepo stream case) will be introduced as successful IWRM stories in South Korea.

6.2. Elements of the new water paradigm in South Korea

6.2.1. Planning mechanism

6.2.1.1. Existing states and emerging problems

A national water policy will have one or more policy frameworks, to be implemented through strategic plans. A policy framework contains objectives and directions while a strategic plan provides priorities based on economic and social feasibility studies (Ongley 2001, 15). In South Korea, the policy frameworks consist of two national plans and the strategic plans consist of two sectoral plans concerning water resources.

The two national plans are the national statutory plans: the comprehensive national territorial plan[148] as the supreme national plan and the long-term comprehensive water resources plan[149] as the framework plan on national water resources. Thus, the government is required to include a proposed multi-purpose dam site in the two main national plans if MOCT wants to construct it.

The two sectoral plans are initiated by water-related ministries and may conflict in policy approaches. The plans share an identical policy objective that is to balance demand and supply of national water, but adopt quite different policy instruments. One is the *Dam Construction Long-term Plan (2001-2011)*[150] that encourages water supply by constructing 20 to 30 dams. The other is the *Comprehensive Plan for Demand-side Water*

[148] It has been updating every ten years since 1972 and includes the water resources section as one of the main parts. Currently, *The 4th Comprehensive National Territorial Plan (2000-2020)* officially takes effect through the Presidential Proclamation # 165 on 8 January 2000 (Government of the Republic of Korea 2000).

[149] It has usually been updating every five years since 1981. The current version is *The Water Plan 2020* (MOCT 2001b) that was released in July 2001 and the next version is scheduled to be released in 2006. The government has been conducting work on the following update version since March 2004.

[150] It was released in December 2001 by MOCT (MOCT 2001a).

Management[151] that is designed to reduce the amount of water demand. Currently, MOCT's dam plan seems dead as the government places emphasis on the demand-side plan suggested by MOE.

The environmentalists and local residents have criticized the national and sectoral plans as neglecting public involvements at all stages. They usually take a tough stand on dam construction project without public approval, especially during the Youngwol conflict. Since the Youngwol veto, the Korean government has reconsidered public involvement mechanisms to adjust to the changing social and political environments.

6.2.1.2. Reform strategies

In this section, I summarize the current reform strategies of the Korean government. *The Environmental Conservation Act* of 1982 introduced the Environmental Impact Assessment (EIS) review process to have an interministerial discussion before project implementation stage, but it was criticized to apply the EIA after getting project approval.

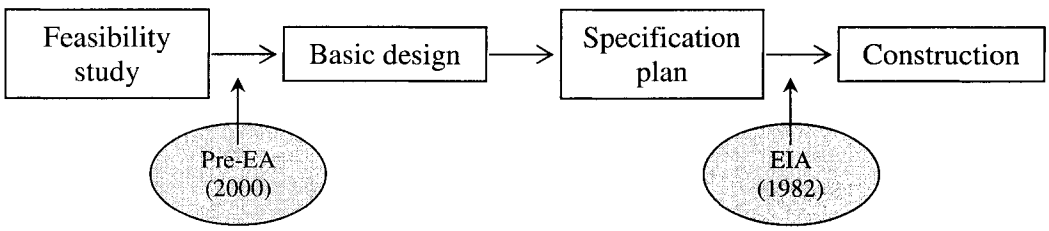

Figure 6-1 Basic concept of EIA and Pre-EA applications

In August 2000, the government introduced the *Pre-Environmental Appraisal* (Pre-EA) to supplement the institutional limitation of the existing EIA. The Pre-EA applies

[151] It was released in March 2002 by MOE (MOE 2003a, 120).

another environmental review process before basic design stage in addition to the existing EIA. It requires development agencies to discuss with MOE before getting government approvals or making decisions on public development projects that are larger than designated standards (MOE 2003a; 247-9; MOCT 2001c; MOE 2003e, 283-4).

There is a double–edged issue on the Pre-EA. The environmentalists urge the government to take a more stringent attitude towards the Pre-EA system by reforming the existing institutional frameworks to implement effective policy actions. They think that poorly defined EIS methodologies would encourage the development agencies to propose additional water projects that would lead to environmental degradations and increase policy conflicts between development and protection sides. However, the industrial circles strongly ask for expanding of deregulatory policies to be competitive in the world market, refuting the regulatory policies like the Pre-EA as barriers to economic development (MOE 2003e, 240).

The development community[152] argues that because South Korea is a small country with high density population, such strict regulatory policies are not proper for South Korea. They insist that South Korea can not afford to enjoy the high-standard environment regulations and strong government regulations that would decrease competitive power of private companies in the world market. On the other hand, the environmental community[153] asks the government to implement more stringent regulation to conserve the national ecosystem and to live with the sustainable environment.

[152] They are stakeholder interests clustered around the development ministries. They usually favor economic growth rather than environmental conservation.

[153] They consist of MOE, environmental NGOs, some citizen's groups, and etc.

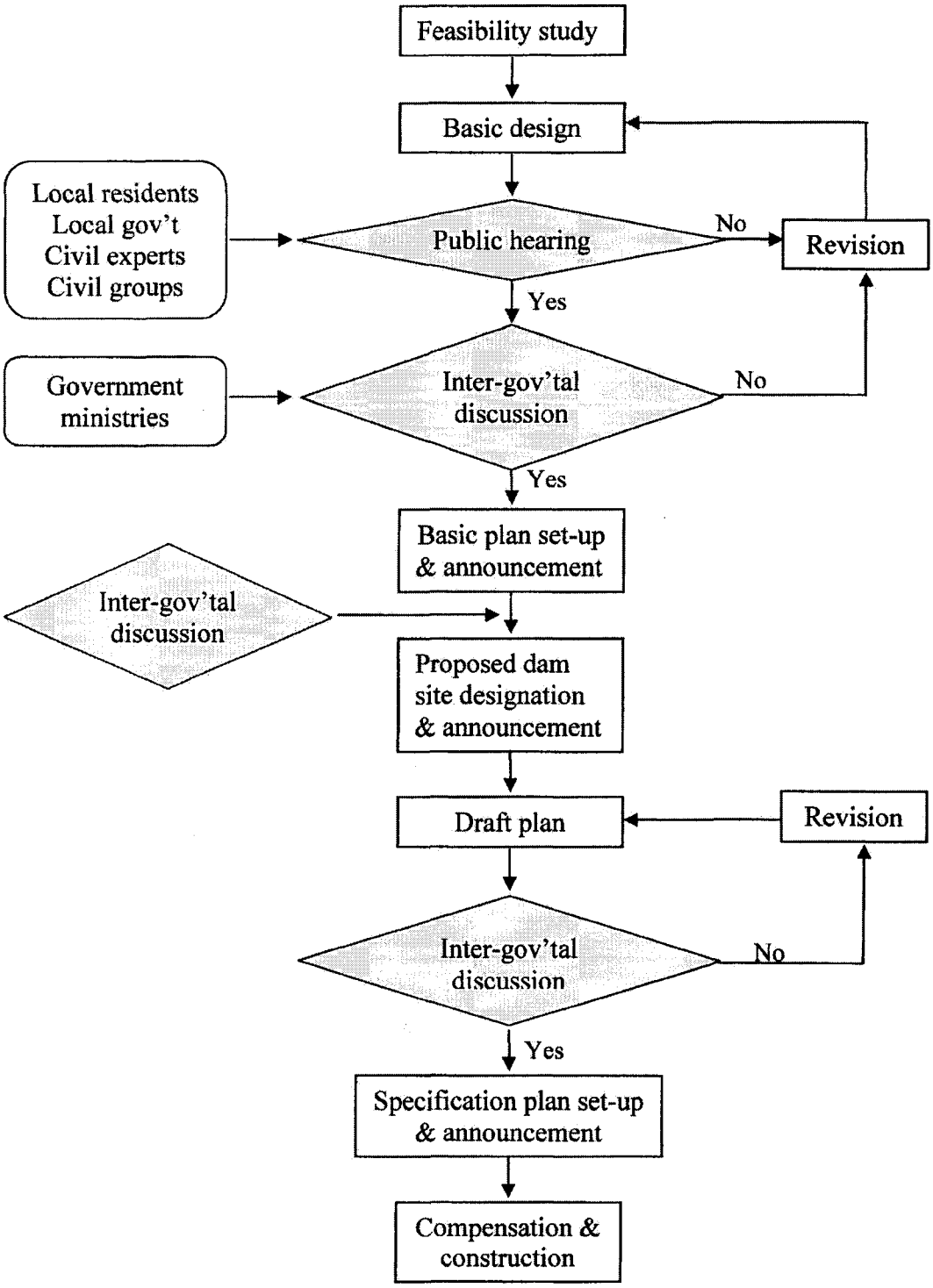

Figure 6-2 New dam construction process (revised from MOCT 2001a, 20)

These conflicting opinions have increased the social conflict level on the environment. The government sometimes hesitated or postponed to decide governmental policies until the two conflicting communities reach a compromise.

The government began to support the environmentalists' claims since the turn of the new century. The change of government's consciousness is reflected into the dam construction process. The government officially announced to enhance public participation process by creating local forums in local areas from the beginning of basic planning stage (MOCT 2001a, 18). Therefore, the public involvement and the planning mechanisms on water development projects in South Korea becomes more open, transparent, and time-consuming process as in Figure 6-2.

The conflicting two sectoral plans may increase interministerial conflicts. To resolve these problems, the President decided to implement a swap program between MOCT and MOE for the first time in the history. It is a landmark decision to exchange two governmental elites to serve for the opposite ministries between MOCT and MOE. The principal rationale of the program is that 'what would you do if you are in my place?'

In January 2004, an MOE officer went to MOCT to serve as the director of the Water Resources Bureau and, vice versa, an MOCT officer to be the director of MOE's Water Supply and Sewerage Bureau. These two bureaus are the main bodies to manage national water resources in terms of water quantity and water quality sectors. The program is intended to consider and implement water policy issues from opposite points-of-view between water development and water protection ministries.

To follow-up the swap program, MOCT and MOE established the Water Management Policy Committee (WMPC) in February 2004 to discuss interministerial water issues

together. The committee will hold at least one interministerial debating forum[154] in every other month to resolve conflicting water issues. For the first cooperative project, they agreed to hold the joint ceremony for the 12th World Water Day in March 2004. The government is expecting to extend this kind of interministerial cooperation to other interministerial conflict areas (MOCT 2004).

At the level of executing body, KOWACO released *The Guidelines to Design Environment-friendly Dams*[155] on December 10, 2003. It is designed to construct environment-friendly dams through conserving natural environment and creating new ecological space in harmony with the environment. The catch phrase of anti-dam movement 'environmentally friendly' used by the environmentalists during the Youngwol conflict in the late 1990s becomes the prevalent motto suggested by present water development agency KOWACO.

6.2.2. Pricing mechanism

6.2.2.1. Existing states and emerging problems

The basic rationale of economic instruments in environmental policy is to charge polluters with the full cost of environmental degradation inflicted by them, or in

[154] Interministerial debates are sometimes not successful to lead conflict resolutions but increase conflict levels because governmental officials and professional experts are not well trained to address complex interdisciplinary problems. Therefore, they are sometimes criticized for their self-interest attitudes of not resolving but increasing conflicts (Lindquist 1992, 154-5). The program represents a strong presidential initiative and ministerial efforts to resolve conflicting interministerial matters.

[155] It is intended to invest more environmental budget in constructing large dams. For examples, KOWACO invests 13% of the Hantangang dam construction cost, or 36 billion won ($20 million), into environmental sector including fish and wildlife conservation facilities. KOWACO had never used such huge environmental budget so far;

economics terms, to internalize the environmental externalities generated by their economic activities (Karshenas 1994, 730). The economic instruments generally emerge in the form of the polluter pays principle. Demand-side water management can be achieved mainly by economic and legal instruments, and the economic instruments include charges, subsidies, taxes, and regulations (Savenije 2001, 88; Karshenas 1994, 730). The water users in the OECD countries are required to pay the full cost of water supply services (OECD 1989; Savenije 2001, 93). South Korea has the duty to follow OECD's guideline as it was invited to join the OECD in December 1996.

Dinar and Subramanian (1998) state that if a water pricing system is properly designed it makes water users improve more effective water allocation and encourage more conservation. However, there is no universally recognized design methodology leading to the best water rate system. Political decision-makers sometimes wish to keep drinking water at low rates to get political supports from the public. That was the same story widespread in South Korea until the late 1990s.

South Korea depends mainly on water supply from man-made large reservoirs. The unit water development cost by constructing large dams has been increased since the 1960s[156]. It accelerated since the late 1980s when South Korea saw the political transition and increasing local opposition against dam construction. The unit cost of water development was only 5.8 won/㎥ in 1973, but increased to 23.6 won/㎥ in 1986

---

http://www.moct.go. kr/mct_hpg/Index/index.php?MID=&HOMEPAGENAME=&DEPT=1500142&UID=.

[156] Water development cost has consistently increased from two interrelated factors in South Korea: exhaustion of proper reservoir sites and rapid increase of compensation expenses. Nearly most of the cost effective dam sites were already utilized to build large dams until the 1980s. With persistent economic growth, the land prices for areas to be

and 192.4 won/㎥ in 1992. The cost jumped more than 33 times during the two decades from 1973 to 1992.

Table 6-1 Water development cost of large dams in South Korea

Dam name	Soyanggang	Chungju	Imha
Construction year	1973	1986	1992
Unit cost (Won/㎥)	5.8	23.6	192.4
Ratio	1.0	4.1	33.2

Source: KOWACO internal data; http://www.kwra.or.kr/korea/re_052.html.

The Korean government supports the water sector by subsidizing huge financial funds. KOWACO supplies water to municipalities at low water rates, for example at 87% in 2002 (CPQSFR 2003). These help to keep the tap-water rates at low prices below the water production cost.

The government policy for the agricultural water rates is different from tap-water rates. Before the political transition in 1987, every Korean farmer should pay the agricultural water rates to the government based on 'the user pays principle.' As the adverse effect of political democracy, the Korean government had to abolish agricultural water rates for farmers in 2000 (KARICO 2002, 27, 32). That means free water supplies for farmers and governmental burdens to subsidize the agricultural water sector since 2000.

The environmentalists have criticized the low tap-water rates as a main cause of wasting water. The government also recognized the adverse effects of the low water rates.

---

underwater have drastically risen since the 1960s. Currently, the compensation cost

Currently, both the government and the environmentalists agree with the necessity to raise tap-water rates, but no change is expecting to the agricultural water rates.

6.2.2.2. Reform strategies

In the late 1990s, the Korean government decided to actualize tap-water rates through reflecting the water production expenses into water use rates[157]. It aimed to raise investment funds for expanding and improving waterworks infrastructures and to reduce the domestic water demand. As seen in Figure 6-3, the actualized percentage of the tap-water rates began to increase from 68.9% in 1998 to 85.9% in 2001, and will attain 100% until 2004. MOCT is also expecting to increase the water rates of the KOWACO's wide-area water service[158] from 87% in 2002 to 100% until 2004 (CPQSFR 2003, 109-10; MOE 2003d, 119-24). South Korea entered into the demand-side water management since 2000 with steep increases in the water rates.

MOE also introduced three economic instruments to induce water conservation. They are the discharge taxation system[159], the water quality improvement liability system[160],

---

comprises more than 60% of the total dam construction cost in South Korea.

[157] MOCT initially devised to cover the full tap-water cost until 2001, but postponed until 2004 to pay regard to reluctant opinions of municipalities. The national average tap-water rates of 1998 were at 70% level of the production cost.

[158] The waterworks service network in South Korea consists of one wholesale water provider (KOWACO) and 167 retail water providers (local municipalities). Each retail provider is responsible for tap-water supply to its local residents (Cho 2004, 10).

[159] It imposes discharge taxation on polluter discharge sites above a standard volume. It is based on 'polluter pays principle' reflected in the *Water Quality Conservation Act* (WQCA) of 1996. It was initially introduced in 1983 and later revised in 1996 to impose discharge taxation equivalent to water treatment expenses.

[160] It defrays environmental expenses based on the *Management of Drinking Water Act* of 1995. It was introduced to conserve groundwater by imposing defrayment on private drinking water enterprises that develop groundwater and sell bottled water in the market (MOE 2003a, 259-61).

and the water use liability system[161]. The three policy instruments imply two important water management principles - 'user pays principle' and 'polluter pays principle' – stipulated in Chapter 18 of Agenda 21. These policy instruments of the new water management system will contribute to improve co-existence and co-prosperity between water users and water polluters, and between upstream and downstream residents of rivers in South Korea.

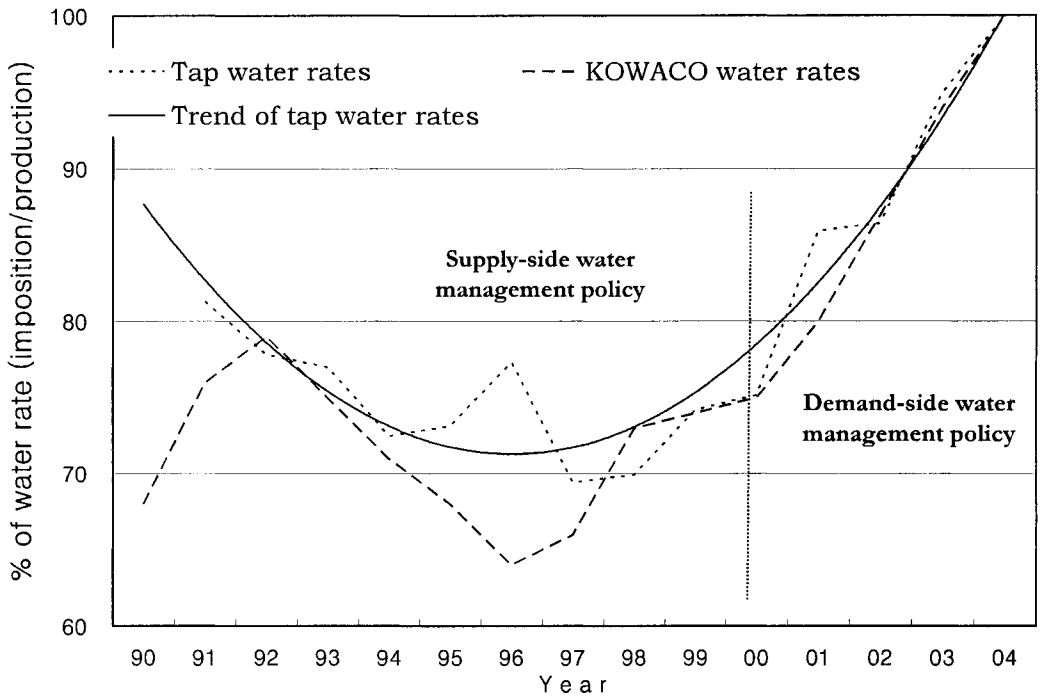

Figure 6-3 Changing pattern of water rates in South Korea[162]

[161] It defrays water use expenses on each end-use customer (downstream residents) based on the Four Rivers Special Acts. Therefore, each downstream water customer has to pay 120 won (approximate 10 cents) per cubic meter each year. The total fund-raising amount is expecting to reach 531 billion won (approximate $443 million) in 2003.

6.2.3. Public participation

6.2.3.1. Existing states and emerging problems

The effective mechanism of public participation encourages stakeholder involvement through promoting environmental equity for disadvantaged social groups (Hampton 1999). According to Tesh (1999, 43), public participation can be achieved through three avenues of the electoral process, the policy making process and the agenda-setting process. Among the three methods, the policy making process comprises of lobbying elected or administrative officials, filing lawsuits, and serving on citizen panels, commissions and boards, or attending public hearings or meetings. The public participation mechanisms, especially the policy making process, of South Korea are still evolving towards environmental equity for disadvantaged social groups.

The Korean government adopted a formal public participation system for the first time in the history as it enacted the *Framework Act on Environmental Policy* (FAEP)[163] in August 1990 by introducing mechanisms of public opinion collection and ex post policy control. They are Pre-EA and MOE's assessment programs on development projects. The FAEP of 1990s was the basic law to declare fundamental principles on the environment and the detail methodologies of the FAEP's principles are specified in the *Act on Environmental Impact Assessment* (AEIA)[164] of 1993. Therefore, the actual public

---

[162] Data source- 1) tap-water rates: KOWACO internal data until 1993, MOE (2003d, 121) for 1994 to 2001; CPQSFR (2003, 109) for 2001 to 2004. 2) KOWACO water rates: KOWACO internal data.

[163] The FAEP was only designed to suggest the general direction of environmental policy, not to define detail methodologies of environmental impact assessment.

[164] It requires public hearings to collect public opinions. It also authorizes MOE to be the discussion body for EIA reports and the permit body for ex-post control and management.

involvement did not realize until detail methodologies of EIA began to specify in the AEIA.

By the way, the government enacted the *Act on Assessment of Impacts of Works on Environment, Traffic, Disasters, etc.* (AIETD) to amalgamate AEIA with three different statutes on traffic, disaster, population in 1999. The AIETD was mainly prepared to reflect the deregulatory politics emerged from the early 1990s in South Korea[165]. The AIETD, however, contributed to extend the collection coverage of public opinion beyond the local residents on ecologically significant projects (MOE 2003e, 242-4, 247).

The increasing pressures for public involvement in water policy formulation emerged since the late 1980s, especially after the Youngwol conflict. The Youngwol case becomes the first vetoed government water project because of failing to get public acceptance. Until the Youngwol conflict, the government did not recognize the changing water paradigm.

The development agencies recognize the EIA mechanism as a mere discussion process to reach project implementation. They are sometimes reluctant to revise the project proposals as suggested by MOE. Thus the environmentalists criticize that the existing EIA statutes does not provide real public participation mechanisms, but only justify the projects through suggesting only pollution reducing alternatives (MOE 2003e, 252).

The poorly defined public participation mechanisms, especially the policy making process, prevented the Korean public from active involvement in the water policy process. The newly enacted Pre-EA (see section 6.2.1.2) and Four Rivers Special Acts (see section

[165] The main objective of AIETD is to relieve temporal and financial burdens of development agents. Thus it unified duplicate impact assessment methodologies for the purpose of removing inefficient mechanisms of the four independent laws.

6.3.1.2) specified more detail methodologies of serving citizen panels, commissions and boards, or attending public hearings or meetings than those in the AEIA of 1993

6.2.3.2. Reform strategies

The Korean government enacted the Four Rivers Special Acts in the five major rivers until 2002[166]. These statutes were enacted through close consultations and extensive trade-offs among various stakeholders[167]. These processes showed introduction of the new water paradigm into Korean water management to apply community-based, bottom-up, and public involvement approaches from agenda setting to policy decision-making (Jeong and Koh 2002, 59-60). The following section 6.3 will discuss public involvement mechanisms applied into the Four Rivers Special Acts.

The issue of public participation is the key concept of IWRM, thus water resources planning without stakeholder participation is very ineffective. However, achieving public participation is challenging as it requires the need for highly decentralized subsidiarity. It also needs direct participation and democratic process (Jaspers 2003, 80-2). Despite South Korea is under ongoing procedure to improve the extent of public participation in water policy decisionmaking process, it needs more efforts to reach to the level of effective stakeholder participation.

---

[166] The Han River Special Act, formally the *Act on Water Quality Improvement of Water Sources and Resident Assistance, etc. in the Han River*, was first enacted in 1999 and followed by similar acts in the remaining major rivers in 2002.

[167] Different from the past policy making process, the government provided extensive public involvement opportunities for the stakeholder interests to enact the Four Rivers Special Acts. The special acts required five years (1998-2002) with 420 open forums and public hearings to lead a grand compromise (MOE 2003e, 378). It was never the case of water policy process before the end of 1990s.

6.2.4. Water governance

6.2.4.1. Existing states and emerging problems

According to Park et al. (2000, 82), there were several interministerial debates on the Korean water governance during the 1990s. The water governance has been a salient issue in South Korea since 1990 when the former Environmental Administration was upgraded to Ministry of Environment (MOE), especially since 1994 when the severe water quality accidents occurred in January and February 1994 in the Nakdong River. The newly upgraded MOE established the Water Quality Conservation Bureau and enacted the *Water Quality Conservation Act* to deal seriously with water quality sector[168].

A dramatic policy change on water governance finally arrived in 1994 when a "window of opportunity" (Kingdon 1984, 173-9) opened[169]. The then-Prime Minister exercised his political authority to make an important decision on the Korean water management system. He completely demarcated the role of water management between MOCT for water quantity and MOE for water quality (Park et al. 2000, 82) and established the Water Policy Coordination Committee (WPCC) as a superordinate organization.

A series of significant water quality episodes directly affected to form the current water management system in South Korea. Unfortunately enough, the current system becomes to oppose the integration principle (section 18.6 and 18.9(a) of Chapter 18 Agenda 21; see Table 2-2) of IWRM thereafter.

---

[168] MOE took over the wastewater treatment sector from MOCT in 1991 and waited for policy opportunities until 1994 to put the whole water quality sector under MOE.

[169] The water quality accidents became "emblematic events" (Hajer 1996) by attracting public and media attentions across the country and brought about a fierce debate on

The current debate on water governance since the turn of the century looks like part of interministerial struggle[170]. As in Figure 6-4, MOCT prefers the policy option B, the water policy coordination system, while MOE wants the option A, the water agency system under MOE. The remaining ministries prefer the current structure or the coordination system to keep their current competent authorities on water[171].

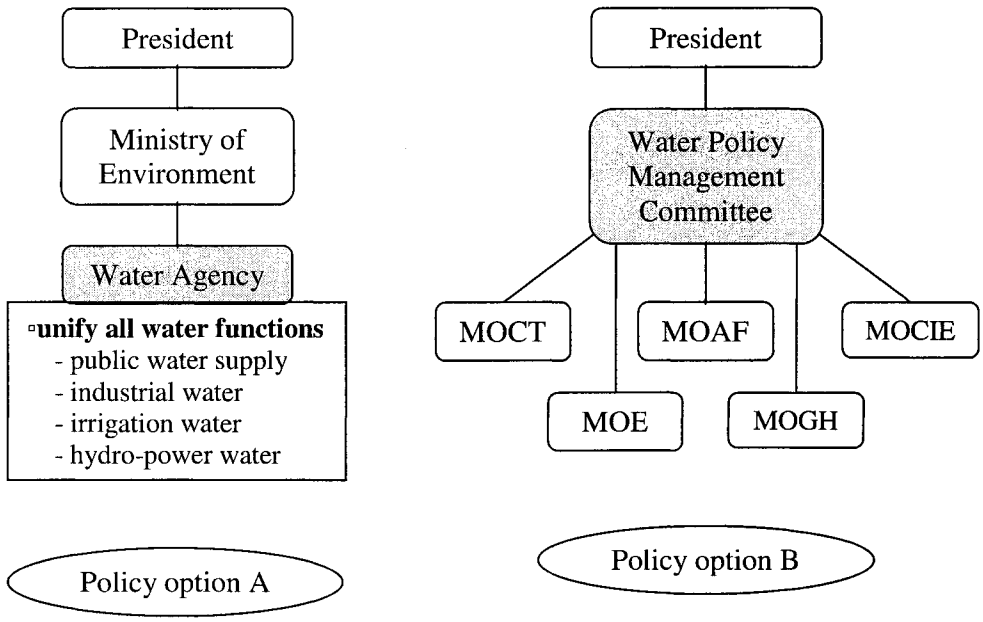

Figure 6-4 Water governance policy options in South Korea

---

government responsibilities for the accidents. According to Rhee and Jeong (2003), a policy window for MOE and against MOCT opened in 1994.

[170] The key point is that how to reorganize the water governance from the existing system. However, they are fighting to increase their own political influence on administrative resources against competing rival ministries (Park and Yi 2003).

[171] The present battle situation on water governance is that MOE attacks to capture the whole water sector and the other ministries defend the status quo against MOE. As a result of significantly divided interests, the water governance issue is likely to be in a dilemma without reaching a compromise among the stakeholder ministries.

Many new policy players[172] entered into the political sphere as South Korea achieved the democratic transition and consolidation since 1987. As a result, the water policy decision-making process also becomes open, transparent, accountable and complex. However, the current water institutional frameworks in South Korea, especially the water governance, keep the old and traditional style that formed during the era of development or authoritarian regime. With drastic change of environmental attitudes since the late 1990s, a social demand to call for new and reforming water governance is increasingly strong and urgent. Currently, many debates and forums[173] provide a wide spectrum of discourses to adapt to new enabling environments for more effective water governance.

6.2.4.2. Reform strategies

MOE asserts the concept of integrated water management as the major rationale for the unified water management system. On the other hand, MOCT proposes the coordinated water management system as a form of check and balance, thus refutes MOE's unified water management system as an old concept. This is the basic conflict structure on the Korean water governance between mainly MOCT and MOE. As a result of the Youngwol's ripple effects, the interministerial debate on water governance has increasingly intensified since the turn of the new century[174].

The Presidential Commission on Sustainable Development (PCSD) of South Korea held a public hearing on the Korean water governance on April 8, 2003. The hearing was

[172] They are stakeholder interests including economists, affected people, sociologists, NGOs, and environmentalists as explained in section 3.2.3 and Table 3-2.

[173] They are many formal and informal debates mainly between MOCT-side and MOE-side governmental officials, scholars, civil society groups.

part of the PCSD's policy initiative to collect public opinion on its research proposal[175] before making policy recommendations to the President (PCSD 2003a, 10-3). The main idea of the proposal is to establish two-tiered water governance: the National Water Management Committee (NWMC)[176] in the central government and the River Basin Water Management Committees (RBWMCs)[177] for major river basins (PCSD 2003a, 39-40) as in Figure 6-5. The proposal specifies the central role of NWMC as a higher-level organization of regional RBWMCs, but it does not specify the relationship between RBWMCs at the regional level and local municipalities at the local level.

The PCSD's proposal looks very similar to the MOCT's proposal (policy option B in Figure 6-4) of the water policy coordination system in the external appearance. Thus, at the public hearing, PCSD was greatly criticized mostly from MOE and the environmentalists for its MOCT-side oriented water governance concept. But it has at least two important improvements from the existing structure: providing legal institutional framework[178] and encouraging extensive public participation[179].

---

[174] The environmental groups turned out having a strong political power since the Youngwol conflict. With the help of the environmentalists, MOE is trying to accelerate its efforts to achieve the unified water management system.

[175] The research was conducted by the Water Governance Improvement Subcommittee under the Water Resources Committee of PCSD from September 2001 to May 2003.

[176] It is designed to consist of committee members from the Prime Minister (chairman), department ministries, and some private sectors. It will form a secretariat body inside the Prime Minister Office.

[177] It is designed to establish new water agencies in the major river basins to manage water resources at river basin scale. However, MOE has already been operating very similar water organizations in the major river basins at the water quality sector.

[178] The PCSD's proposal requests to provide a legal basis for the proposed coordinating body by enacting the *Framework Act on Water Management*, tentatively titled, as a basic water law for the Korean water management. The current coordination system has not the legal basis but a Prime Minister's directive.

[179] The PCSD's proposal encourages extensive public participation by opening decision-making process to local residents, civil society, and local experts in decision

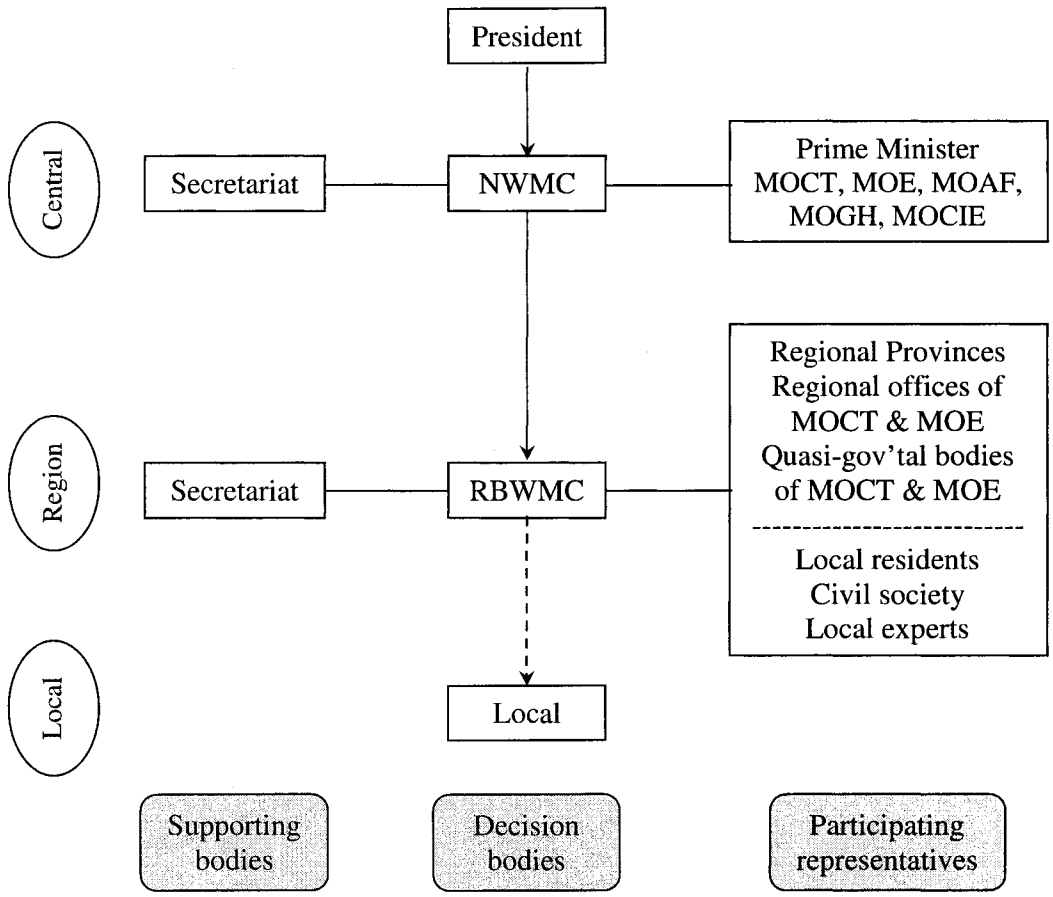

Figure 6-5 Policy proposal of water governance suggested by PCSD

process while the existing system is still comprise of representatives of governmental bodies.

6.3. Towards the new water paradigm

6.3.1. Active government efforts

6.3.1.1. Comprehensive water management measures

As discussed in section 5.2.4, the water quality accidents of the Nakdong River in the early 1990s left enormous emblematic effects (Hajer 1996) on the Korean water management practices. The first accident occurred in the Nakdong River in 1991 served as a momentum to reconsider water issues at a zerobase. The government set up *The Comprehensive Measures for Clean Water Supply (1993-1997)* and invested 16.0 trillion won ($13.3 billion) to improve source water quality (CPQSFR 2002b, 3).

Despite of the government policy to conserve river water quality, the second water quality accident broke out again in 1994. The 1994 accident pushed the government opening a policy window (Kingdon 1984) to change the national water policy in three perspectives. The first was to set up the *Framework Plan on Comprehensive Measures for Water Management (1996-2011)* in August 1996. The plan requires a total of 90.8 trillion won ($75.7 billion)[180] to expand available water resources (62.2 trillion won; $51.8 billion) and to improve water quality (28.6 trillion won; $23.8 billion) (CPQSFR 2002b, 4).

The second change came from adopting the new water paradigm into the Korea water policy. The government began to focus on more innovative water management through introducing precautious water quality programs including the total maximum daily load (TMDL) system (see section 6.3.1.2), integrating diverse and divided governmental water

[180] Investment until 2003 reached 50.9 trillion won ($42.4 billion) (CPQSFR 2004, 5).

information systems, and reorganizing the water-related government structure (see 6.2.4.1) (CPQSFR 2004, 3-5).

The third change made on the water-related government structure in 1997. The government established the Water Policy Coordination Committee (WPCC) as a superordinate organization above water-related ministries (see section 6.2.4) and the Commission on Protection of the Quality and Supply of Freshwater Resources (CPQSFR) under the Prime Minister Office as its secretariat body (CPQSFR 2004, 3). Since their establishments, WPCC and CPQSFR have played important roles in integrating separated water policies in the five water-related ministries. However, because of their limited authorities in formulating integrated water policies (Park and Yi 2003), the issue of water governance reform becomes a salient debate in the Korean society in the 2000s (see section 6.2.4).

6.3.1.2. Four Rivers Special Acts

With deteriorating water qualities in the major rivers, the Prime Minister of South Korea finally asked an epoch-making government policy to conserve the national water. To follow-up his order, MOE prepared the *Comprehensive Measures of Water Management for the Four Major Rivers* that was completely different government water program from the previous ones. Its policy objective is to secure safe water and supply stable drinking water to the Korea people by investing 15.3 trillion won ($12.8 billion) until 2005. The government adopted several policy instruments to achieve the objective. Four policy instruments are worthy of notice among them: the total maximum daily load

(TMDL) system[181], the riparian buffer zone system[182], the water use liability system[183], and the land purchasing system[184] (MOE 2003e, 378-9; CPQSFR 2003, 83-5).

Table 6-2 Main features of the comprehensive measures for the four rivers

River	Policy decision	Program period	Program goal (BOD ppm)	Funding	
				Korean won (billion won)	US $ ($ million)
Han	Nov. 20, 1998	1998-2005	1.5 → 1.0	2,639	2,199
Nakdong	Dec. 30, 1999	2001-2005	4.5 → 3.0	8,457	7,048 [a)]
Geum	Oct. 24, 2000	2001-2005	3.2 → 2.0	2,724	2,270
Youngsan	Oct. 24, 2000	2001-2005	2.9 → 1.9	1,502	1,252
Total				15,322	12,769

Note: a. It includes funding for water resources of 4,210 billion won ($3,508 million).
Source: MOE (2003e, 379); CPQSFR (2003, 84).

[181] It sets standards of particular pollutants for rivers and reservoirs to handle without violating ecosystem. The Kwangju city in Han River is expecting to implement the TMDL system in 2004 for the first time in the country. The city released *The TMDL Management Plan of Kwangju city for 2003-2007* and held public hearings in July 2003. The government is also planning to extend the TMDL area in the Han River. The local municipalities in the other major rivers - Nakdong River, Geum River, and Youngsan River - should adopt the system from 2004 if they fail to meet water quality standards in their neighboring streams or rivers.

[182] It is designed to create riparian buffer forests by restricting landuse within a certain distance from streams. The government currently designates the buffer zone of 255 ㎢ in the Han River, 287 ㎢ in the Nakdong River, 373 ㎢ in the Geum River, and 222 ㎢ in the Youngsan River. However, the actual restricting area is much larger than the riparian buffer zone area because there are other restricting areas under the tap-water source protection zone, the greenbelt zone, and the military conservation zone.

[183] It is explained in the preceding section 6.2.2 and footnote 161.

MOE initiated the Four Rivers Special Acts for the five major rivers to provide the legal base of the comprehensive measures. The *Act on Water Quality Improvement of Water Sources and Residents Assistance, etc. in the Han River Basin* of 1999 was followed by three more special acts[185] of 2002. MOCT also enacted the *Act on Construction of Dams and Assistance, etc. to their Environs* of 1999[186].

The measures and the special acts that were initiated by MOE and are focusing on water quality sector, also left very significant marks in the Korean water resources sector. The government provided extensive public involvement opportunities for the stakeholder interests including the central ministries, local governments, local residents, and the civil society. More than 420 open forums and public hearings were held during five years from 1998 until 2002 (MOE 2003e, 378). The special acts are transforming the Korean water management practices from conventional top-town, supply-driven, government-led, and strict regulatory water quality policies towards more participatory, anticipatory, and collaborative approaches.

6.3.2. Voluntary local watershed movement: case of Daepo stream

The water quality issue became one of the most government concerns until the late 1990s as the government considered to implement strong regulatory programs. The

---

[184] It is designed to purchase private lands or structures within the riparian buffer zones. It compensates the private property right if the owners sell them (MOE 2003e, 379-87).

[185] Act on Water Quality Improvement of Water Sources and Residents Assistance, etc. (AWWR) in the Nakdong River Basin; AWWR in the Geum River Basin; and AWWR in the Youngsan River and the Seomjin River Basin.

[186] It was criticized from the environmental community from the policy formulation stage for its goal to encourage dam construction through extensive governmental assistance to local residents. However, it contributed to enhance public participation and collaborative approach to water management.

Daepo stream[187] was so polluted to be wastewater-like waterbody that no fish could survive in it before December 1997. Even more serious concern came from the fact that the stream flows into the Mulgeum water intake area[188]. To relieve the severe water quality condition in the Nakdong River, MOE was preparing to enact the Four Rivers Special Acts to improve water qualities in the major rivers and to designate the Daepo stream as a tap-water protection zone[189], the Zone hereafter, in February 1997.

The local residents of the Daepo stream immediately responded against the designation of the Zone because such strict regulations would infringe on the local residents' private property rights. The local community began to feel uneasy from the outside threat. According to Jeong, the responses of the local residents had finally transformed from resistance to self-governance for the water quality issue. The relationship between the government and the local residents proceeded along several stages from opposition to collaboration (Jeong and Koh 2002, 63).

In 1997, the local residents formed the Anti-Special Act Committee to mobilize local capacity in coupled with neighboring communities. With strong opposition from the residents, the government decided to postpone the designation for a while in July 1997 until the local community made a compromise among stakeholder interests. During the protest process, the residents began to realize their unjustified arguments on the significantly polluted stream. In the meantime, the local municipality, the City of Kimhae, persuaded the residents of the unavoidable condition for the Zone. Finally, the residents

---

[187] It is a small tributary in the downstream of the Nakdong River with 8.9 ㎞ long and 3,098 residents in its watershed of 45.8 ㎢ (Jeong and Koh 2002, 62).

[188] It is the major tap-water source for the Busan metropolitan areas, the second largest city in South Korea.

and the City of Kimhae agreed to transform the existing Anti-Special Act Committee into the Water Quality Improvement Committee to initiate a voluntary local watershed movement (MOE 2003f).

Table 6-3 Evolution of the Daepo watershed movement

Stage	Period	Action	Situation	Result
1	Before Feb. 1997	Gov't plan to set a Zone	Emergence of outside threats to the local interests	Local agitation
2	Feb. 1997 - Jul. 1997	Local request of withdrawal	Residents' opposition to the government action	Concession from the government
3	Aug. 1997 - Dec. 1998	Local initiative	Residents' voluntary movement to improve water quality	Local committee
4		Local efforts	Improving water quality in the stream	Level 4 (1997) → level 1 (1998)
5	Jan. 1999 - Dec. 2001	Local success	Gaining public recognition on the local efforts	Attentions from outsiders
6	After Jan. 2002	Scraping the plan	Creating a precedent for local watershed movement	Win-win success

Source: Summarized from Jeong and Koh (2002, 63-6).

From August 1997, the residents started a voluntary watershed movement[190] to improve water quality of the stream. Next, the committee asked neighboring factories and farms out of community to participate its watershed movement by reducing wastewater discharges. Sometimes the committee laid formal complaints for unapproved discharges

[189] It requires strict landuse regulations to most economic activities that generate water pollutants within the Zone under the *Water Supply and Waterworks Installation Act.*

[190] They started with a fundraising campaign in the local area to get necessary financial resources for the watershed movement. Then, they hired two staffs to monitor water pollution activities in the stream, conducted one or more clean-up day in every two week, encouraged women to reduce using detergent or washing soap when laundry works, etc.

of violating polluters before the regional authority. It took only one and half years for the stream to transform into water quality level 1 (very good level) from level 4 (very bad level). Until the end of 1998, the stream successfully recovered a nice ecosystem to be live with many species of birds and fishes, even rare species (MOE 2003f).

The successful story of the Daepo stream attracted much attention from outsider including the government and the civil society[191] as a new approach to resolve local water quality problems. Finally, for the first time in the Korean history, *The Voluntary Agreement for Water Quality Improvement on the Daepo Stream* was signed among the local committee, Mayor of Kimhae, Governor of Kyungnam Province, and Minister of MOE on 3 April 2002. They agreed to suspend the applications of the Zone and the TMDL system on the Daepo stream as far as the local community keeps the stream water quality at the water level 1. It is a successful watershed movement of the local residents and a win-win story between the local community and the government.

The mass media reported the unbelievable reality of the Daepo stream in succession since 1998[192]. In October 2003, MOE prepared the *Guideline for Selecting Good Examples of Local Communities for Preserving and Recovering National Ecology* to encourage and support the Daepo-like community-based watershed movements across the country (MOE 2003g).

[191] Especially, MOE noticed the voluntary community-based way as a good example to reach compromise among stakeholder interests. The then-minister of MOE visited the stream to encourage the residents on October 9, 1999.

[192] The story was televised by the Seoul Broadcasting System on March 16, 2001 and the Korea Broadcasting System on August 9 and on July 24, 2002 as a miracle achievement.

6.3.3. Achievements of the new paradigm

The stories of the comprehensive water management measures, the Four Rivers Special Acts, and the Daepo case imply successful applications of the core IWRM norms into the South Korean water management. According to Jeong and Koh (2002, 60-1), the special acts are formed with principles of participatory decision making, watershed-based management, anticipatory and preventive approach and water as economic goods. In the first, they are collaborative results from compromising among a variety of stakeholder interests. Secondly, each of the special acts manages each river basin – politically divided - as the extent of jurisdiction. Thirdly, they apply anticipatory and preventive approaches[193] to preserve their ecosystem. Finally and the last, the acts treat water as economic goods by introducing the water use liability system[194]. The Daepo case is a voluntary, community-based, bottom-up, and participatory watershed movement within a stream. The local committee serves as the center of watershed movement based on catchment area (MOE 2003e, 378; MOE 2003f).

The active government efforts and the local watershed movement adopt ex ante pollution control approaches away from traditional ex post discharge treatment approaches. In addition, the government has encouraged voluntary public participation instead of applying the conventional regulatory approaches in managing water and the environment across the country. The fundamental spirits of the approaches applied on the Korean water management correspond with the new water paradigm components

[193] The acts adopt the TMDL system to permit only allowable pollutant discharge and the riparian buffer zone system by setting the buffer zone (300 m up to 1 ㎞) around the major water sources and reservoirs.

discussed in section 2.3.1 and Table 2-1 and the international consensus of IWRM discussed in section 2.3.2 and Table 2-2.

6.4. Conflicting perspectives on the new water policy

6.4.1. Positive perspective

The Korean government has transformed the national water policy from the supply-side management to the demand-side management since the turn of the century. The positioning direction of the changed policy is shown in the *Comprehensive Plan for Demand Water Management* released in March 2002 (MOE 2003a, 120). The goal of the new policy is to achieve water saving up to 790 million m^3/year until 2006 by applying various policy instruments including water saving facilities and water rate actualization.

According to the *White Paper on the Environment for 2003*, MOE analyzed that the total water saving 450 m^3 during 1999 to 2002 was accrued mainly from water saving facilities (214 m^3), aged water networks replacement (105 m^3), and water rate actualization (114 m^3). In addition, the per capita water use has reversed to a decreasing pattern during the period from 395ℓ in 1998 to 374ℓ in 2001. As a result of water saving amount, 450 million m^3 until 2002, its economic benefit reached up to 377 billion won ($314 million) (MOE 2003e, 447-8).

[194] It applies the beneficiary pays principle to raise operation funds for water and environmental management within a river basin and to compensate of the infringing property rights of upstream residents.

Table 6-4 Water policy instruments and their water saving achievements

(Unit: million m³/year)

Instrument \ Year	Total	1999	2000	2001	2002
Total	450.0	43.2	131.5	94.3	181.0
Water saving facilities	214.3	12.0	54.0	32.6	115.7
Recycled water systems	17.0	8.9	55.7	1.0	1.1
Aged networks replacement	104.6	22.3	25.7	26.7	29.9
Water rate actualization	114.1	-	46.1	34.0	34.0

Source: Adapted from EPA (2003e, 448: Table 2-7-13).

6.4.2. Negative perspective

The MOE's opinions are critically challenged from different points of view. Kim (2003) denies MOE's proposed achievements – the water saving amount and the decreasing pattern of tap-water use. He suggests that the per capita water use was actually still under a increasing pattern. He mentions that MOE misunderstood the water use pattern as it was based on unreliable data analysis[195].

Another negative argument came from unfavorable opinions of the general public against water rates increase. According to the *Survey Report of the Public Consciousness*

[195] He points out two flaws that MOE did not recognize in the analysis. The first flaw is not to utilize of the real water use based on water meters. The second is that MOE's misunderstanding on the concept of per capita water use. He maintains that MOE regarded the per capita water use as the inside-house use only. According to his calculation, the total water use amount and the per capita water use increased during 1998 and 2001. The increasing pattern suggested by Kim is completely different from the MOE's opinion of the decreasing pattern. He explains that per capita inside-house water

on Environmental Conservation released in September 2003, the public were reluctant to pay more tap-water rates because 54.9% of people opposed to the government policy to increase them. The negative response of 2003 increased by 20.8% for three years from 34.1% in 2000 (MOE 2003b). The public is likely to feel tired with the continuing increase of water rates since 1999.

Such sentiment is supported by Doo-Hwan Youn, a Representative of the National Assembly. He criticized the KOWACO's water rate actualizing program at the parliamentary inspection meeting of KOWACO held on 25 September 2003. He pointed out three problems of the KOWACO's water rate program: over-profit of KOWACO[196], cheap water rate syndrome[197], and inefficient use of operational facilities[198] (Youn 2003). He concluded that to be actualized was not the water rates but the government's water policy because the KOWACO's water rates had already increased to reflect the production cost.

Furthermore, the general public does not recognize the tap-water quality as safe to drink. The Korean public rarely drinks raw tap-water without treatment or boiling[199]. The

---

use decreased at 1.8% while outside-house water use increased at 24% during the period (Kim 2003).

[196] He asserted that the operating profit for the waterworks sector of KOWACO had increased more than 500% during only the last two years from 18.7 billion won (approximately $15 million) in 2001 to more than 100 billion won (approximately $83 million) estimated in 2003.

[197] He also noted the nonsense of comparing the Korean water rates directly with those of some advanced countries. Kim (2003) agreed with Youn's opinion that the tap-water rate of South Korea was not cheap to induce water wasting. He mentioned that the tap-water rates of South Korea was lower than France, and higher than many advanced countries including Italy, the United States, Australia, the United Kingdom, and Japan considering the per capita income of each country.

[198] He pointed out inefficient use (only 62%) of water supply facilities caused by over invested capacity. The KOWACO's inefficiency led high water production cost.

[199] According to the *Survey Report of Public Consciousness on Water* released in 2003 by MOCT (2003), 77.8% of the public didn't drink the tap-water in their houses: 5.7%

Korean public do not trust the government water policy any more. The social distrust on the tap-water results in continuing high increase of bottle water sale since the mid-1990s except the year of Asian economic crisis in 1998. As of 2002, the Korean public had to pay 218 billion won (nearly $182 million) to drink more than 2 million m³ of bottle water.

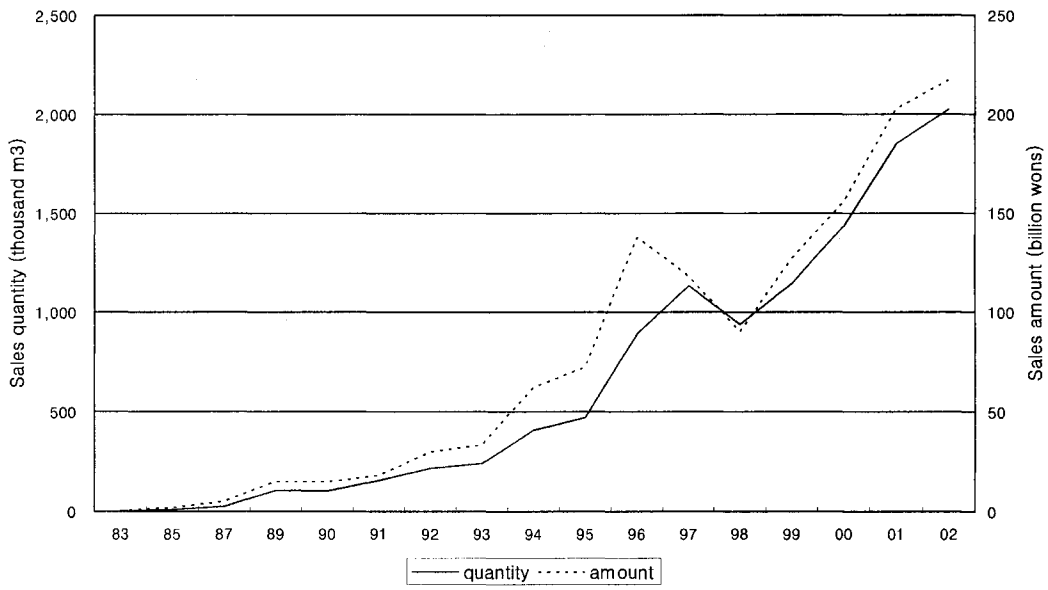

Figure 6-6 Sales of bottle water in South Korea[200]

6.5. Concluding remarks

The concept of the new water paradigm was first introduced into South Korea in 1992 when some Koreans participated at the UNCED conference. However, the concept did not attract the public attention until the Youngwol conflict and the deteriorated water

---

depended on private groundwater, 6.6% on spring water, and remaining 9.9% on bottle water. Even among the public who drank the tap-water, nearly most (95.1%) of them relied on privately purified water or boiled water. The remains drank raw tap-water without any treatment or boiling (1.5%) or combined water of raw or boiling (3.4%).

quality conditions of the major rivers in the late 1990s. The significant aftermath of the episodes pushed the government to reconsider social, economic, and environmental values of water in formulating national water policy. Since 1992, it took nearly ten years for South Korea to recognize the meaning of IWRM inspired from the UNCED conference.

The comprehensive water management measures and the Four Rivers Special Acts led by the government, and the case of Daepo stream watershed movement led by a local community are three clear evidences of the new water paradigm that put down roots in South Korea. Those cases adopted innovative water management approaches shifting away from command and control, government-led, top-down, and regulatory towards voluntary, community-based, bottom-up, and participatory.

[200] Data from EPA (2003e, 473: Table 2-7-33).

7. Evaluations and conclusions

7.1. Summary

As stated in chapter 1, the goal of the dissertation was to analyze evidence from international and national perspectives of the new paradigm, regional water conflicts, and the driving forces for the new paradigm to show why the four policy elements are important and how they are changing IWRM in South Korea. This analysis included reviews of water management experiences of the United States and South Korea to provide comparative perspectives and to identify and assess important factors for the new water paradigm in South Korea. It also discussed four major IWRM elements and five categories of driving forces. The final stage of the analysis is to map further improvements needed to advance the practice of IWRM in South Korea.

Chapter 2 gave definitions and reviewed the global literature about changing water paradigms. It reviewed Chapter 18 of Agenda 21 suggested by UNCED conference and derived four important IWRM components that are essential to understand the new water paradigm in South Korea. These were planning, pricing, participation, and governance.

Based on analysis of water management at the national level in South Korea and the United States, and at the state level in the United States, chapter 3 compared management characteristics of the two countries. The countries face similar needs, where new and more holistic thrusts are needed, including capacity–building and demand-side water management. So, while the nations are different, they face many similar issues.

Although the United States is a western nation with a history of economic and political stability it still must improve its national and state water management institutions to apply IWRM principles through its water policies. South Korea, as a fast-developing and

newly democratized oriental country, must review global perspectives on IWRM and national water policies and adapt them to the changing Korean environment. The American experiences are especially important in voluntary, community-based, bottom-up and participatory strategies.

Chapter 4 discussed the outcomes of the new paradigm at work at the project level in South Korea and the United States where two regional water projects, in different decades and different places, without apparent close relationships, were not completed. The two water conflicts show why the new paradigm is important, how it will change water policies in both countries, who should apply it, and what the effects will be. They also indicate similarities and differences between the Korean case and the American case and show the factors that should be recognized to apply the new paradigm in South Korea.

Chapter 5 discussed the economic, political, social, environmental, and technological driving forces that led to the new water paradigm in South Korea. Economic change provided an opening for political democracy and new environmental values. Political change accelerated public participation and governmental accountability. Social change also encouraged public participation and governmental accountability by providing diversified perspectives in the Korean society. Environmental change increased public consciousness towards environment conservation since the 1980s and intensified environmental regulations later. Technological change promoted by the Internet and networked society contributed to participatory democracy in the water policy process.

Evidence presented by OECD showed that a national water policy is generally apt to change if environmental groups effectively utilize emblematic effects of severe accidents. The South Korean case also showed that extreme water events led the public to

reconsider existing water management practices. The changed public attitudes about the environment led politicians and the government to change the dominant water development discourse. The events of the early 1990s led water policy windows open after the late 1990s.

Chapter 6 focused on the four principal IWRM components (planning, pricing, public participation, and water governance) and reviewed three important water management practices initiated by the government (comprehensive water management measures and the Four Rivers Special Acts) and a voluntary local watershed movement (the Daepo stream). These successful IWRM stories in South Korea show how it took nearly ten years for South Korea to recognize the meaning of IWRM inspired from the UNCED conference of 1992.

After 2000, and as shown by the three water management practices, South Korea embraced the new water paradigm more directly. Evidence shows that water management shifted away from traditional policy strategies (command and control, government-led, top-down, and regulatory approaches) towards innovative and win-win alternatives (voluntary, community-based, bottom-up, and participatory approaches).

7.2. Evaluations

7.2.1. Overall evaluation

South Korea falls into the water stress group (see section 3.2.1) to be ranked at 146th out of 182 countries (including regions) in the world according to the available renewable water resources per capita per year (UNESCO 2003a, 72) or the hydrological Water Stress

Index (WSI)[201]. Measured in cubic meters per person per year, its available water resources are only 1,490, much less than Canada (94,353), the United States (7,407 in mainland), and France (3,439), and similar to United Kingdom (2,465), Poland (1,596), Somalia (1,538), Lebanon (1,261), Denmark (1,128) and South Africa (1,154).

Ohlsson suggests use of the Social Water Stress Index (SWSI)[202] through dividing WSI by the Human Development Index (HDI)[203] to improve the limitation of WSI - direct numerical comparison of hydrological and population conditions. His idea is that SWSI would explain a country's ability in dealing with water scarcity better than WSI by considering the country's social adaptive capacity because "the HDI would offer much better proxy for social adaptive capacity of a society than merely the standard economic classification of the World Bank" (Ohlsson 1999, 209-10).

According to his calculation, South Korea has an excellent social adaptive capacity as of 1995, because it improves its SWSI rank (114, ranking from best to worse) as compared to its WSI rank (132). Thus, South Korea can be characterized not in the water stress group but in the relatively sufficient group. He says that South Korea becomes the most improved country in the world among transforming countries from water stress to relatively sufficient, thus it is recognized as having high ability of social adaptive capacity (Ohlsson 1999, 211-2).

---

[201] WSI is the number of hundred individuals who share one million cubic meters of available renewable water per year. The concept is based on the Falkenmark's suggestion (Falkenmark 2001, 237; Falkenmark and Widstrand 1992, 19).

[202] SWSI can be calculated through dividing WSI by HDI for each country and 2. He uses a divider 2 to directly compare the two indices WSI and SWSI (Ohlsson 1999, 248).

[203] HDI is "a composite index measuring average achievement in three basic dimensions of human development": the PPP based GDP per capita, the life expectancy index, and the education index; http://hdr.undp.org/reports/global/2003/indicator/indic_8_1_1.html.

Table 7-1 Comparison of hydrological versus social water stress

Item \ Year		Unit	**1995** (Ohlsson 1999)	**2001** (UNESCO 2003a)	
				Internal	Total
Available renewable water		㎦/yr	66.10	64.85	69.70
Per capita available renewable water		㎥/yr/person	1,472	1,387	1,491
WSI		-	6.8 (132/159)	7.2 (147/182)	6.7 (146/182)
HDI		-	0.890[204]	0.879	0.879
SWSI		-	3.8 (114/159)	4.1	3.8
Water group	WSI	-	Stress	Stress	Stress
	SWSI	-	RS	RS	RS
Rank difference		-	18	-	-

Source: a. All information of 1995: selected from Ohlsson (1999, 250).
b. Renewable water of 2001: selected from UNESCO (2003a, 72).
c. HDI of 2001: from UNDP HD Report Homepage at http://hdr.undp.org.

Note: a. Rank difference (132-114=18) is based on Ohlsson's calculation.
b. Water groups based on WSI & SWSI value- RS (relative sufficiency) (0-5), stress (6-10), scarcity (11-20), absolute scarcity (above 20).
c. Internal of 2001 means renewable water resources within the national boundary. Total includes shared water resources with North Korea.
d. WSI value 132/159 means 132nd out of 159 countries (best → worst).

The United Nations (UNESCO 2003a, 140) announces that South Korea ranks eighth in Water Quality Indicators (WQI)[205] in its *World Water Development Report*. The

[204] Ohlsson misused 0.890 (as the 1995 HDI value of South Korea) instead of 0.848 (the real value of it based on the UNDP website at http://hdr.undp.org/reports/global/2003/indicator/cty_f_KOR.html). As a result, the SWSI value of South Korea in 1995 should be 4.0 instead of 3.8. However, the final result is the same because he used the rounded values for the WSI and the SWSI.

indicator value of South Korea (1.27) ranks behind Finland (1.85), Canada (1.45), New Zealand (1.53), United Kingdom (1.42), Japan (1.32), Norway (1.31) and the Russian Federation (1.30), and better than most countries, including France (1.13; 10th), the United States (1.04; 12th), Switzerland (0.87; 16th), Australia (0.73; 20th) and Italy (0.47; 31st). However, these are somewhat suspicious how the Russian Federation can have good indicator value and the advanced countries like France, the United States, and Switzerland have lower values than South Korea[206].

As seen in Table 7-2, the international community refers to South Korea as having excellent social adaptive capacity in managing its water resources effectively with little available water resources. According to Ohlsson, the combined evaluation of the hydrological WSI (WSI) and the social WSI (SWSI) of South Korea shows the evidence of excellent institutional capacity to cope with water quantity scarcity. The Water Quality Indicator represents excellent government policies to deal with water quality scarcity. Thus, South Korea is recognized to have proper social adaptive capacity to address overall water issues.

Even though the international community evaluates South Korea as an excellent country in the overall water management performance, domestic assessments are severely critical to its achievements. Nearly 95% of the Korean people still worry about water quality problems (see section 5.2.4 and Figure 5-3). Most of the Korean water experts are

---

[205] The data of Water Quality Indicator came originally from the *Global Report 2001-2002* (World Economic Forum and Yale University 2002, 116). WQI is not a simple water quality indicator but derived from a huge amount of global water quality data available including "the widespread occurrence of poor water quality, the diversion of water from natural aquatic ecosystems, and the emerging problems with groundwater quality and recharge" (UNESCO 2003a, 139).

[206] The UN only suggests WQI values and ranks without explaining how those numbers can be calculated in its *World Water Development Report* (UNESCO 2003a).

not satisfied with the current water management practices: 15.1% (satisfactory) and 80.2% (unsatisfactory) (MOCT 2003). Most of the Korean public (72.5 %) has a negative attitude toward the current government policy on river management (Kwon 2001). As a result, the Korean people give the government a failure grade F to the national environmental management: the general public (47.9 out of 100 points) and the environmental experts (56.5 points) (MOE 2003b).

Table 7-2 Overall evaluations of water management practices in South Korea

Item	Indicator	Data year	Value	World rank (best → worst)	Evaluation
Water availability	Water Stress Index	2001	1,490 (m^3/yr) 7 (index)	146/182	Water stress
Water resources (water quantity)	Social Water Stress Index	1995	4 (index)	132/159 (WSI) 114/159 (SWSI)	Excellent
Water protection (water quality)	Water Quality Indicator	2001	1.27 (index)	8/122	Excellent

Source: Water availability– from UNESCO (2003a, 72); Water resources– from Ohlsson (1999, 250); Water protection– UNESCO (2003a, 140).

Such a great gap between international and domestic evaluations may come from different points of view in measuring water management performances. The international community like the United Nations evaluates the active governmental efforts, enormous public investments, and their visible achievements (for examples, improvements in water supply and water quality) in the water sector (see section 6.3.1) and compares them to those of other countries to recognize the relative performance of South Korea.

On the other hand, the Korean people may pay more attention to their everyday life environments including water quality issues in rivers and water shortage issues in new

developing sites. In addition, they rarely drink the raw tap-water without treatment or boiling because they do not trust the tap-water quality any more as safe to drink (see section 6.4.2). They get stressed from the government policy to increase the tap-water rates (see sections 6.2.2. and 6.4.2). They also saw the interministerial conflicts on the Youngwol conflict (see chapter 4) and on water governance (see section 6.2.4). These domestic factors may lead the Korean public to focus more on absolute water management performance within the nation rather than the relatively better achievements in the international community.

7.2.2. Sectoral evaluation of IWRM components

South Korea is moving towards an economic reflexive paradigm as explained in Table 2-6 and sustainability considering its water management practices and social adaptive capacity. The four principal IWRM components under internationally recognized IWRM norms suggested by Chapter 18 of Agenda 21 are being applied in water management practices since the beginning of the 2000s. However, despite its initiatives to achieve IWRM principles (see section 2.3.2), the processes of planning, pricing, public participation, and water governance are not fully implemented in South Korea.

For example, the planning mechanism does not fully integrate water and environmental management, interministerial conflicts still exist between MOCT and MOE, and the development community argues against the current Pre-EA system (see section 6.2.1).

The pricing mechanism has just been arranged since about 2000 and is still being challenged from local municipalities and the affected residents (see section 6.2.2).

Furthermore, the alleged achievements of the demand-side water management are challenged as being somewhat ineffective (see 6.4.2).

Public participation is so important in water resource planning process because the process without stakeholder involvement is highly ineffective (Japser 2003, 80). The public participation mechanism has improved a great deal since the late 1990s through including stakeholder interests in water policy decision-making processes like Youngwol dam project (see chapter 4). However, the government elites are still reluctant to implement the subsidiarity principle or decision-making at the lowest appropriate level (see section 6.2.3).

Water governance to reorganize water management structure has become the most important issue in the Korean water sector (Choi and Choi 2002). However, a severe interministerial conflict still exists between MOCT and MOE. They seem to be more interested in keeping their vested interests than achieving IWRM principles and sustainability (see section 6.2.4; Park and Yi 2003).

Table 7-3 reviews IWRM applications and their achievements in South Korea according to the four principal IWRM components. As discussed in chapter 6, all components are moving towards sustainability, but it has a long way to go to fully achieve the philosophy of the new water paradigm.

7.3. Conclusions

The new water paradigm is derived from internationally recognized norms in water resources planning and management. The domestic emblematic effects generated by the extreme water quality accidents coupled with the environmental movement finally led the

Korean public to reconsider existing water management practices, thus opened windows of opportunity in the late 1990s. As a result, the old water development ideology is being replaced with the new paradigms of ecocentrism. In South Korea, this paradigm includes a move from the supply-side to the demand-side water management. This required South Korea to understand the new paradigm that was enabled by socio-economic developments since the 1960s.

Table 7-3 IWRM applications and their achievements in South Korea

Division / Component	International consensus (reflected in Agenda 21 Chapter 18)	Application in South Korea (referring chapter and section)
Planning	18.6- the holistic management of freshwater. 18.9(b)- water plan within the framework of nat'l economic development policy. 18.16- water plan in an integrated manner of env'tal/economic/social considerations.	Improving, but not fully achieved Achieved (section 6.2.1) Improving, but not fully achieved (section 6.2.1)
Pricing	18.8- perception of water as a social and economic good. 18.9(c)- projects & programs are both economical efficient & social appropriate. 18.15- water as a social & economic good.	Improving (6.2.2) Improving (6.3.1) Improving (6.2.2)
Public participation	18.9(c)- projects & programs based on full public participation.	Improving (6.2.3)
Governance	18.6- effective implementation and coordination mechanism are required. 18.9- integration at catchment basin level. 18.9(d)- proper institutional/legal/financial mechanism. 18.12(k)- integration of water quantity & quality management.	Discussing, but challenging (6.2.4) Improving (6.2.4; 6.3.1.2) Improving (6.2.2; 6.2.4; 6.3.1) No, completely separated (6.2.4.1)

Considering the positive recognition that South Korea's water management has earned (see Table 7-2), and the huge amounts of financial investment into the water sector (see section 6.3.1), the country has achieved a great improvement since 1990. However, it

faces many tough difficulties to advance into more efficient and more effective states of water management and needs additional efforts to implement the new paradigm.

South Korea's comprehensive water management measures (see section 6.3.1.1) explain how the society has placed priority on the water sector. The Four Rivers Special Acts (see section 6.3.1.2) show that the South Korean government understands the IWRM principles and applies them into water policy. In addition, the Korean people possess positive attitudes towards environmental conservation and are willing to participate in voluntary water conservation activities as discussed in the case of the Daepo stream (see section 6.3.2) for a community-led watershed movement.

Water demand is beginning to outstrip water supply. Until the beginning of 1990s, South Korea met water demands by constructing new projects. With increased political democracy and social change during the 1990s, it became difficult to build new large dams, especially after the Youngwol conflict in the late 1990s. Thus, South Korea began to pay more emphasis on the demand-side water management since the turn of the century. Now, to overcome the imminent water shortage problem, South Korea should recognize water as a scarce good and prepare for the adaptive water management.

As large dam construction has become nearly impossible since the 2000s, the water demand amount is expecting to exceed the water supply capacity in the near future, possibly before around 2010. MOCT expects that water shortage will emerge from 102 million m^3 in 2006 and reach to 2.6 billion m^3 in 2020 without necessary dam constructions[207] (MOCT 2001b, 46).

[207] MOCT's idea of SWM was critically challenged by MOE and the environmentalists. Currently, the government is preparing a new water plan with participation of the environmental groups to produce an impartial national water plan.

As depicted in Figure 7-1, South Korea has already entered into the demand-side water management phase possibly since the end of 1990s. It is evidenced by the increase of tap-water rate and the adoption of economic instruments as discussed in section 6.2.2. The Korean style hydraulic mission or the period of multi-purpose dam construction is recognized to be demised until the end of 1990s.

However, the water policy based on the end-use efficiency would not be enough to cope with the water deficit stage probably since around 2010 when the water demand exceeds the socially available water supply. Since then, South Korea should adopt significantly painful allocative water policies until around 2040 or 2050 to balance demand and supply of water.

Despite of its adoption of water pricing instruments during the demand-side water management, South Korea will face severe water shortage problems unless more innovative and effective water saving policies are implemented before around 2010. Such policies will need high social adaptive capacity, and more social and political capacity rather than technical expertise. Figure 7-1 shows the past and future water management patterns of South Korea with reference to water demand and available water supply. There are some assumptions[208] in depicting Figure 7-1.

[208] The initially available volume from rivers (12.5 billion m^3) is the available amount of stream water use in 1978 (MOCT 1980, 35). The socially available volume from dam building (35.5 billion m^3; 35.16 in the four rivers + 0.36 billion m^3 in others in 2011) (MOCT 2001b, 46-7). The physically available volume is an arbitrary number. The water demand data until 2020 come from MOCT (2001b, 13, 34) and Choe (2003, 103). I separate them into yearly basis. Because no official data is available after 2021, I suppose the water demand would decrease since 2021 with increasing rate during 2021 and 2035 and decreasing rate during 2036 and 2050. As a result, the maximum water demand under the trend curve is expected to happen around between 2025 and 2030.

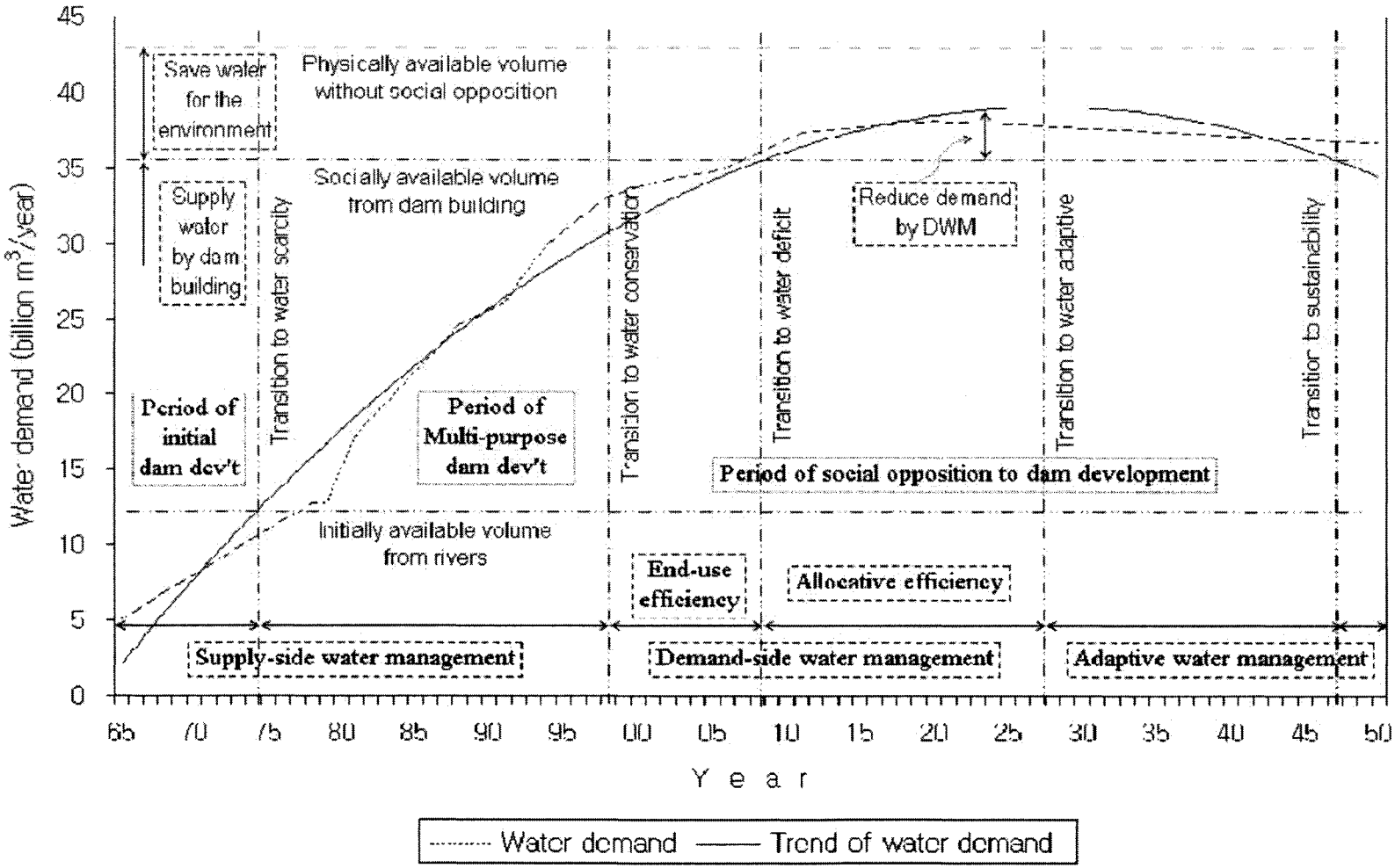

Figure 7-1 Water management patterns of South Korea from water development to sustainability

The Korean society began to learn negotiation and cooperation approaches to solve water conflicts by establishing the Water Quality Improvement Committee for the Daepo stream in 1997 (see section 6.3.2), the Joint Task Force for Comprehensive Feasibility Study on Youngwol project in 1999 (see section 4.3.2), and the Water Management Policy Committee for interministerial water issues in 2004 (see section 6.2.1.2). These are recognized as new conflict resolution methods by the government and the local residents because stakeholder interests voluntarily participate in decision-making processes and discuss water issues directly.

For the Youngwol project as a severe regional conflict, stakeholder interests agreed to establish the Joint Task Force to review the project again at a zero-based stage. Even though the government played an important role in decision-making process, public participation was effective at the national level.

For the interministerial conflict, the government implemented an unprecedented swap program to coordinate conflicting water policies between MOCT and MOE. In response to the program, MOCT and MOE established the Water Management Policy Committee. Such government initiative is expecting to make water management practices more negotiable and cooperative.

In case of the Dapeo stream, the local residents always led the watershed movement for their community by establishing an operating body and taking necessary measures to clean their neighboring streams.

Furthermore, the President of South Korea asked the Presidential Commission of Sustainable Development (PCSD) to make negotiating and persuading processes based on justice and expertise in December 2003 (Blue House 2003a). PCSD recognized that

'top-down policy-making' and 'closed information flow' are the two most challenging barriers in decreasing levels of water conflicts and in moving towards to the stage of sustainable development for the Korean society. Now, the PCSD is preparing to develop new dispute resolution mechanisms to improve smooth information flow and supposed to submit a report to the President (Blue House 2003b).

To overcome unintended water problems in the near future, South Korea needs emphasis on top-down governmental initiatives and bottom-up public involvement. However, policy reforms on planning, pricing, public participation and water governance will not happen by chance. Even though active environmental movements and emblematic effects will lead water policy changes in the future, South Korea should enhance its social adaptive capacity by improving technical, social, and political capacities. Providing mechanisms for cooperation (Turton 2000, 20) and coordination (Grigg 1998) will be necessary conditions to increase the social adaptive capacity.

Turton and Ohlsson (1999) maintain that the natural resource reconstruction in Figure 2-4 can be achieved if a society has proper capacity-building to generate DWM strategies and the willingness and ability to accept them (see section 2.3.4.2). Ohlsson (1999, 211-2) recognizes South Korea as having necessary capacity-building to transform its adverse hydrological water condition into a relatively sufficient societal water condition (see Table 7-1).

The Korean water experts agreed to the principle of integrated management of water resources at the public hearing of PCSD in 2003 (see section 6.2.4.2). The Korean public has shown greater concerns towards environmental protection (see section 5.2.4) and increased willingness to participate environmental movements (Koo 1999) since the

water quality accidents in the beginning of the 1990s. All these enhance the necessary social adaptive capacity to enable the DWM strategies as both reasonable and legitimate alternatives. Furthermore, the DWM strategies can be effectively formulated and implemented when stakeholder interests interact with cooperation and coordination.

To move towards a sustainable society, South Korea should manage national water resources more efficiently and more effectively. The initial phase of the demand-side management is not enough to prepare for the coming water scarcity deficit period. South Korea should prepare for allocative efficiency and adaptive water management by enhancing social adaptive capacity (see section 2.3.4). Sustainable development can be attained through fully implementing the four principal IWRM components reviewed in Table 7-3, and then South Korea can proceed to the phase of natural resource reconstruction.

In the future, the reform strategies of the four principal IWRM components that were discussed in section 6.2 will lead South Korea to greater capacity-building to generate more effective DWM strategies and increased public willingness and government ability to accept them as both reasonable and legitimate policy alternatives. The reform strategies are also expected to decrease levels of water dispute through greater cooperation and coordination between stakeholder interests. The successful enactment of the Four Rivers Special Acts would be a precedent for the new paradigm of changed roles of government ability and public willingness and greater contribution of cooperation and coordination.

Finally, the dissertation illustrated the concept of "paradigm-prototype-protocol." That is, the new international paradigm for IWRM has been imported to South Korea for

application in a national prototype that is unfolding now. In the future, this should be the protocol that will drive concepts for IWRM.

References

Adams, Alison. 1998. *Analysis of regional water conflicts: The case study approach.* Ph.D. dissertation, Colorado State University. Fort Collins, Colorado.

Aiken, Mike. 2000. Reflexive modernization and the social economy. *Studies in Social and Political Thought* 2: 3-21. United Kingdom: University of Sussex.

Alegre, H., W. Hirner, J.M. Baptista, and R. Parena. 2000. *Performance indicators for water supply services.* IWA Publishing.

Alexander, Cynthia and Leslie Pal. 1998. *Digital democracy: Policy and politics in the wired world.* Oxford University Press.

Allan, J.A. and M. Karshenas. 1996. Managing environmental capital: The case of water in Israel, Jordan, the West Bank and Gaza, 1947 to 1995. In *Water, peace and the Middle East: Negotiating resources in the Jordan Basin*, ed. Allan J.A., 121-133. London: I.B. Tauris & Co. Ltd.

Allan, Tony. 2001. *The Middle East water question: Hydropolitics and the global economy.* London: I.B. Tauris Publishers.

Anderson, James E. 1997. *Public policymaking: An introduction.* Mifflin Company.

AWWA (American Water Works Association). 1990. *Water rights of the fifty states and territories.* Denver: AWWA.

AWWA (American Water Works Association). 1994. *Integrated resource planning: A balanced approach to water resources decision making.* Denver: AWWA.

Babbit, Bruce. 2000. A new course for water policy. *World Rivers Review* 15, no. 1: 10-11.

Bank of Korea. 2003. *World development indicators 2003 euro bon segye sok eui hankuk kyungje* (The economic status of South Korea in the world looking from the World Development Indicators 2003). Seoul, South Korea.

Barnett, Neil. 2003. *Governance, networks, and deliberative democracy.* Paper to the Political Studies Association Annual Conference, April 15-17, 2003. http://www.psa.ac.uk/cps/2003%5CNeil%20Barnett.pdf (12 Dec. 2003).

Bass, Ronald and Albert Herson. 2000. SEA of water management plans and programs: Lessons from California. In *Perspectives on strategic environmental assessment*, ed. Maria Rosario Partidario and Ray Clark. Lewis Publishers.

Bates, Sarah, Charles Wilkinson, David Getches. 1993. *Searching out the headwaters: Changes and rediscovery in western water policy.* Island Press.

Baumgartner, Frank and Bryan Jones. 1993. *Agendas and instability in American politics.* Chicago: The University of Chicago Press.

Beck, R., T. Bik, and B. Dziegielewski. 1999. *Benchmark investigation of small water system economics*. Department of Agribusiness Economics and Department of Geography, Southern Illinois University.

Beck, Ulrich. 1992. *Risk society: Towards a new modernity*. London: SAGE.

Bell & Howell Company. 1979-1986. *The Denver Post Index*. Ann Arbor, Michigan.

Black, Peter E. and Brian L. Fisher. 2000. *Conservation of water and related land resources*. 2nd ed. Lewis Publishers.

Blue House. 2003a. Galdeung haegyul: hyupeui suldeuk tonghan seungbok munhwa ro (Dispute resolution: towards a negotiation culture through process of agreement and persuasion). *Cheongwadae Beuriping* (The Blue House Briefing) 200: 7. December 16, 2003. Seoul, South Korea.

Blue House. 2003b. Mul energy sahoi galdeung gwaje jeongchak jean (Policy proposal for water, energy, and social conflict projects). *Cheongwadae Beuriping* (The Blue House Briefing) 200: 7. December 16, 2003. Seoul, South Korea.

Borzel, Tanja. 1998. Organizing Babylon: on the different conceptions of policy networks. *Public Administration* 76, no. 2: 253-273.

Bressers, Hans, Laurence O'Toole, Jr, and Jeremy Richardson. 1995. *Networks for water policy: A comparative perspectives*. Franks Class & Co., Ltd.

Brouma, Anthi. 2003. *Bridging the GAP: Modernity versus post-modernity- Which water management paradigm?* Paper prepared for the Kokkalis Graduate Workshop, February 7, 2003, Harvard University.

Bulkeley, Harriet. 2003. Participation and environmental governance: consensus, ambivalence, and debate. *Environmental Values* 12: 143-154.

Bulkley, Jonathan. 1995. Integrated watershed management: past, present, and future. *Water Resources Update* 100: 7-18.

Capra, Fritjof. 1988. *Uncommon wisdom: conservationists with remarkable people*. New York: Simon and Schuster.

CDWR (California Department of Water Resources). 1998. *California water plan update bulletin 160-98*, volume 1. Sacramento, California.

Chan, Steve. 2000. Democracy inauguration and transition in East Asia. In *Pathways to democracy: The political economy of democratic transitions*.

Cho, Eun-chae. 2004. Tide of change: Restructuring of water service industry. *Mul* (Water) January. Korea Water Resources Corporation.

Choe, Dong-Jin. 2003. mulbujok sidae eui gongup yongsu gwanri jeongchak (Industrial water management policy for the water deficit period). In *Proceeding of Water Policy Symposium*, March 27, 2003, Seoul, South Korea, by the Saving Water for Life Campaign. http://ecojustice.or.kr (25 Sep. 2003).

Choi, Yearn-Hong and Gil-Soo Choi. 2002. Hwankyung jeongchak ae kwanhan yeongu (A study of consciousness on environmental policy). *Hankook Jibang Jachi Hakhwoibo* (Local Autonomy Research) 14, no. 1.

COE (Army Corps of Engineers) Omaha District. 1988. *Metropolitan Denver water supply final environmental impacts statement (EIS), Summary.* March 1988.

COE (Army Corps of Engineers) Omaha District. 1989a. *Two Forks Dam and Reservoir Record of Decision (ROD).* March 1989.

COE (Army Corps of Engineers) Omaha District. 1989b. *Two Forks Dam and Reservoir Section 404 Permit Application Supplemental Information Document (SID).* January 1989.

COE (Army Corps of Engineers). 1999. *Digest of water resources policies and authorities.* EP 1165-2-1. July 30, 1999.

CPQSFR (Commission on Protection of the Quality and Supply of Freshwater Resources), Office of the Prime Minister. 2002a. *2002 nyondo mulgwanri tonggye jaryojib* (The water management statistical databook of 2002). Seoul, Korea.

CPQSFR (Commission on Protection of the Quality and Supply of Freshwater Resources). 2002b. *2002 nyondo mulgwanri jonghab daechak silchun gyehoik* (The practical plan of comprehensive water management for 2002). Seoul, Korea.

CPQSFR (Commission on Protection of the Quality and Supply of Freshwater Resources). 2003. *2003 mulgwanri baekseo* (The white paper on water management for 2003). Seoul, Korea.

CPQSFR (Commission on Protection of the Quality and Supply of Freshwater Resources). 2004. *2003 nyondo mulgwanri jonghab daechak silchun gyehoik jeomgum bunseok gyulgwa* (The review and analysis of the practical plan of comprehensive water management for 2003). Seoul, Korea.

Cumings, Bruce. 2000. Democracy and civil society in Korea. In *Pathways to democracy: The political economy of democratic transitions,* ed. James F. Hollifield and Calvin Jillson.

Davies, J. S. 2000. The hollowing-out of local democracy and the 'fatal conceit' of governing without government. *The British Journal of Politics and International Relations* 2, no. 3.

Deb, A., Y. Hasit, and F. Grablutz. 1995. *Distribution system performance evaluation.* American Water Works Association.

Dietz, Simon and Neil Adger. 2001. *Economic growth, biodiversity loss and conservation effort.* Center for Social and Economic Research on the Global Environment, Working Paper ECN 01-03. Norwich, United Kingdom: University of East Anglia.

Dinar, Ariel and Ashok Subramanian. 1998. Policy implications from water pricing experiences in various countries. *Water Policy* 1: 239-250.

DWB (Denver Board of Water Commissioners). 1997. *Water for tomorrow: The history, results and projections of the Integrated Resource Planning.* July 1997.

DWB (Denver Board of Water Commissioners). 2002. *Water for tomorrow: The history, results, projections and update of the Integrated Resource Plan.* February 2002.

EC (The European Commission). 1998. *Towards sustainable water resources management: A strategic approach.*

Ellision, Brian A. 1993. *The Denver Water Board: Bureaucratic power and autonomy in local natural resource agencies.* Ph.D. dissertation, Colorado State University.

Ellision, Brian A. 1998. Intergovernmental relations and the advocacy coalition framework: The operation on federalism in Denver water politics. *Publius: The Journal of Federalism* 28, no. 4: 34-54.

EPA (Environmental Protection Agency). 1997. *EPA strategic plan.* http://www.epa.gov/ ocfo/plan/ epastrat.pdf (25 May 2003).

EPA (Environmental Protection Agency). 1999a. *EPA 2000 strategic plan.* http://www. epa.gov/ocfo/plan /2000strategicplan.pdf (25 May 2003).

EPA (Environmental Protection Agency). 1999b. *EPA 2000 annual plan.* http://www.epa. gov/ocfo/budget/ 2001/2001plan.pdf (25 May 2003).

EPA (Environmental Protection Agency). 2002. *Index of watershed indicators: An overview.* Office of Wetlands, Oceans, and Watersheds.

EPA (Environmental Protection Agency). Region VIII. 1989a. *Fact Sheet: Proposed 404(c) determination for Two Forks Dam and reservoir.* August 29, 1989.

EPA (Environmental Protection Agency). Region VIII. 1989b. *Proposed determination to prohibit, restrict, or deny the specification, or the use for specification, or an area as a disposal site: South Platte River.* August 29, 1989.

EPA (Environmental Protection Agency). Region VIII. 1990. *Recommended determination to prohibit construction of Two Forks Dam and Reservoir pursuant to section 404(c) of the Clean Water Act.* March 1990.

EU (The European Union). 2000a. *Directive 2000/ /EC of the European Parliament and of the Council of establishing a framework for the Community action in the field of water policy.* 30 June 2000.

EU (The European Union). 2000b. *Directive 2000/60/EC of the European Parliament and of the Council of establishing a framework for the Community action in the field of water policy.* 23 October 2000.

Falkenmark, Malin and Carl Widstrand. 1992. Population and water resources: A delicate balance. *Population Bulletin* 47, no. 3. Population Reference Bureau, Inc.

Falkenmark, Malin. 2001. The Ven Te Chow memorial lecture. *Water International* 16, no. 4: 229-240.

Falkenmark, Malin. 2003. *Water management and ecosystems: Living with change.* TAC Background Papers No. 9. Technical Committee, Global Water Partnership.

Feldman, David Lewis. 1991. *Water resources management: In search of environmental ethic.* The Johns Hopkins University Press.

Fiorino, Daniel. 1995. *Making environmental policy.* The University of California Press.

FWS (Fish and Wildlife Service) Region 6. 1987. Fish and Wildlife Coordination Act Report. 15 October 1987.

GAO (General Account Office). 2000. *Managing for the results: Continuing challenges to effective GPRA implementation.*

Gardiner, J.L. and N.C. Perala-Gardiner. 2000. Conservation, ecosystem use and sustainability. In *Global perspectives on river conservation*, ed. P.J. Boon, B.R. Davies and G.E. Petts. John Wiley and Sons, Ltd.

Gleick, Peter. 2000. The changing water paradigm: A look at twenty-first century water resources development. *Water International* 25, no. 1: 127-138.

Goodland, Robert. 1997. Environmental sustainability in the hydro industry: Disaggregating the debate. In *Large dams: Learning from the past looking at the future*, ed. Tony Dorcey. IUCN/The World Bank Group.

Gould, George, and Douglas Grant. 1995. *Cases and materials on water law.* 5th ed. West Publishing Co.

Government of the Republic of Korea. 2000. *The 4th Comprehensive National Territorial Plan (2000-2020) in Korea.* Seoul, Korea.

Grigg, Neil S. 1996. *Water resources management: Principles, regulations, and cases.* McGraw-Hill.

Grigg, Neil S. 1998. Coordination: The key to integrated water management. *Water Resources Update* 111: 23-29.

GWP (Global Water Partnership). 2000. *Integrated water resources management.* TAC Background Papers No. 4. Technical Advisory Committee, GWP.

Hajer, Maarten. 1995. *The politics of environmental discourse: Ecological modernization and the policy process.* Oxford: Clarendon Press.

Hampton, Greg. 1999. Environmental equity and public participation. *Public Sciences* 32: 163-174.

Heclo, Hugh. 1978. Issue network and the executive establishment. In *The new American political system*, ed. Anthony King. Washington: American Enterprise Institute.

Hinchman, Steve. 2000a. EPA to Denver: Wake up and smell the coffee!. In *Water in the West*, edited by Char Miller. Oregon State University Press.

Hinchman, Steve. 2000b. Two Forks proposal has roused western Colorado. In *Water in the West*, ed. Char Miller. Oregon State University Press.

Homer-Dixon, Thomas. 2000. *The ingenuity GAP.* Canada: Alfred A. Knopf.

Hong, Sung-Man. 2000. *Jeougbuwa bijeongbu jojik eui jeongchak gyungjaeng* (A study on the policy competition between the government and non governmental organizations: Case of the Youngwol Dam policy). Ph.D. diss., Korea University.

Hornby, Susan and Zoe Clarke. 2003. *Challenges and change in the information society.* Facet Publishing.

Hsu, Shu-Hsiang. 2004. Democratization and water management in Taiwan. *Water International* 29, no. 1: 61-69.

IWA (International Water Association) and UNEP. 2002. *Water management: Industry as a partner for sustainable development.* The Beacon Press. http://www.uneptie.org/outreach/wssd/contributions/sector_reports/sectors/water_management/water.htm (3 Sep. 2003).

Jaspers, Frank. 2003. Institutional arrangement for integrated river basin management. *Water Policy* 5: 77-90.

Jeong, Hoi-Seong and Jae-Kyung Koh. 2002. A community-based approach for the environmental conservation policy in Korea: focusing on water quality improvement movement of Daepo-chon residents. *Hwankyung jeongchak yeonkoo* (Environmetnal Policy Research) 1, no. 1: 49-76. Korea Environment Institute.

Joo, Jae-Bok and Sung-Man Hong. 2001. *Joongang bucheo gan jeongchak galdeung gwa jojeong gije* (The policy conflict and mediation mechanism between central government bodies). Article presented to the summer meeting of Korean Association for Public Administration. Seoul, South Korea.

Jung, Woon-Hyun. 2001. Hankook unron eui maeche bipyung hyunhwang gwa gwaje (The present and task of mass media criticism for the Korean mass media). *Kwanhoon Journal* 79. Seoul, South Korea.

Jwa, Sung-Hee. 2001. *A new paradigm for Korea's economic development: From government control to market economy.* PALGRAVE.

Kallis, Giorgos and David Butler. 2001. The EU water framework directive: Measures and implications. *Water Policy* 3: 125-142.

KARICO (Korea Agricultural Rural Infrastructure Corporation). 2002. *Mulgwanri juyo jeongchak byunhwa yechuk mit daeeung banghyang yeongu* (Prediction of the major policy changes on the irrigation water management and its countermeasures). Seoul, South Korea.

Karshenas, Massoud. 1994. Environment, technology and employment: Towards a new definition of sustainable development: *Development and Change* 25: 723-757.

Katsuhama, Yoshihiro. 2003. *Effective dam planning and implementation after the World Commission on Dams report.* Master thesis, Colorado State University.

Kempton, Willett, James Boster, and Jennifer Hartley. 1995. *Environmental values in American cultures.* The MIT Press.

Kenney, Douglas S. 1997. *Resource management at the watershed level: An assessment of the changing federal role in the emerging era of community-based watershed management.* Report to the Western Water Policy Review Advisory Commission.

Kettl, Donald. 2002. *The transformation of governance: Public administration for twenty-first century America.* The Johns Hopkins University Press.

Kim, Hye-Jeong. 1999. Anti-dam movements of Korea. In *Problems of dam construction policy & alternatives for the 21st century: Proceedings of the Environmental*

NGOs' International Symposium on Dams, Seoul, South Korea, Nov. 29 to Dec. 1, 1999, by the Korean Federation for Environmental Movement. http://www.kfem.or.kr/engkfem/issue/damsympo/damsympo_e.html (3 Nov. 2003).

Kim, Itae. 2003. *Mul jeolyak jonghap daechak chujin siljeok bunseok mit jeun* (Analysis and recommendations for achievements of the comprehensive water management plan). http://water21.re.kr/nimage/down/kimitae.pdf (4 Jan. 2004).

Kim, Kyun. 2001. Sinmun eui sinmun bipyung i naagaya hal gil (The way of critical essays of newspapers). *Kwanhoon Journal* 79. Seoul, South Korea.

Kim, Sang-Bae. 2004. IT sidae kookmin kukga eui byunhwa wa global jeongchi eui hyungsung (The change of citizen nation and formation of global politics in the IT period). In *IT eui sahwoi munhwa jeok younghyang yeongu: 21 segi hankook megatrends* (Social and cultural effects of IT: The Korean megatrends in the 21st century), proceedings of the final symposium, Seoul, South Korea, 12 March 2004 by Korea Information Strategy Development Institute.

Kim, Shin. 2000. *Migook yeongbang jeongbu eui seonggwa gwanri chegye: GPRA sihaeng 7 nyon eui seonggwa wa gyohoon* (The performance management system of the federal government of the United States: The progress and lessons learned from the seven years' implementation of GPRA). Article presented at the summer conference in 2000 of Korea Public Administration Association.

Kim, Sunhyuk. 2000. Patronage politics as an obstacle to democracy in South Korea: Regional networks and democratic consolidation. In *Democracy and its limits: Lessons from Asia, Latin America, and the Middle East*, ed. Howard Handelman and Mark Tessler. Notre Dame, Indiana: University of Notre Dame Press.

Kingdon, John. 1984. *Agendas, alternatives, and public policies*. HarperCollins College Publishers.

Koo, Do-Wan. 1999. 1980 nyondae ihooeui hankookin eui hwankyung euisik (The environmental consciousness of the Korean people since 1980s). *Hwankyung Jeongchak* (Environmental Policy) 7, no. 2.

Koo, Hagen. 2001. *Korean workers: the culture and politics of class formation.* Ithaca: Cornell University Press.

Kraft, Michael and Denise Scheberle. 1998. Environmental federalism at decade's end: New approaches and strategies. *Publius: The Journal of Federalism* 28, no. 1: 131-146.

Kraft, Michael E. and Norman J. Vig. 2000. Environmental policy from the 1970s to the 2000: An overview. In *Environmental policy*, ed. Norman J. Vig and Michael E. Kraft. Congressional Quarterly Inc. Washington, D.C.

Kuhn, Thomas S. 1970, 1996. *The structure of scientific revolutions*. 2nd, 3rd ed. Chicago: The University of Chicago Press.

Kuznet, S., 1955. Economic growth and income equality. *American Economic Review* 45, no.1: 1-28.

Kwon, Oh-Hyun. 2001. Kookmin eun dam eul wonhanda (The public want dams). *Gunsul Journal* (Construction Journal) (July). Construction and Economic Research Institute of Korea. Seoul, South Korea.

Lee, Namhee. 2002. The South Korean student movement. In *Korean society: Civil society, democracy, and the state*, ed. Charles K. Armstrong. London: Routeledge.

Lee, See-Jae. 2000a. Movement against damming the Tong River. In *Proceedings of International Workshop on Environmental Peace in East Asia*, Seoul, South Korea, July 5-7, 2000, by the Korean National Commission for UNESCO. http://www.unesco.or.kr/eng/science/d_2.html (9 May 2003).

Lee, See-Jae. 2000b. Movement against the construction of the Tong River (Youngwol Dam) in Korea. In *Large dams and their alternatives in East & South East Asia: Experiences and lessons learned: Proceedings of the WCD's 4th and Final Regional Consultation*, Hanoi, Vietnam, Feb. 26-7, 2000, by Asian Development Bank. http://www.dams.org/docs/kbase/submissions/ins176.pdf (3 Nov. 2003).

Lindquist, Evert A. 1992. Public managers and public communities: Learning to meet new challenges. *Canadian Public Administration* 35, no. 2: 127-159.

Loucks, Daniel, and John Gladwell. 1999. Sustainability criteria for water resource systems. UNESCO. Cambridge University Press.

Loucks, Daniel. 2000. Sustainable water resources management. *Water International* 25, no. 1: 3-10.

Lowi, Theodore. 1964. American business, public policy case studies and political theory. *World Politics* 16 (July): 677-715.

Lowi, Theodore. 1972. Four systems of policy, politics, and choice. *Public Administration Review* 32, no. 4: 298-310.

Lownders, Vivien and Chris Skelcher. 1998. The dynamics of multi-organizational partnerships: An analysis of changing modes of governance. *Public Administration* 76, no. 2: 313-333.

Luecke, Daniel F. 1990. Controversy over Two Forks Dam. *Environment* 32, no. 4: 42-45.

Lundqvist, Jan. 2000. Rules and roles in water policy and management: Need for clarification of rights and obligations. *Water International* 25, no. 2: 194-201.

Maddaus, William O. 2001. *Water resources planning*. Denver: AWWA.

Margerum, Richard D. 1995. Integrated watershed management: comparing selected experiences in the U.S. and Australia. *Water Resources Update* 100: 36-47.

Marston, Ed. 2000. Ripples grow when a dam dies. In *Water in the West*, ed. Char Miller. Oregon State University Press.

McCormack, Gavan. 2002. Water margins: competing paradigms in China. *Critical Asian Studies* 33, no. 1: 5-30.

Meehan, Elizabeth. 2003. *From government to governance: Civic participation and 'New Politics'*. Occasional Paper # 5. School of Political and International Studies, Queen's University of Belfast. Northern Ireland.

Meyer, Andrea, Cornelis van Kooten, and Sen Wang. 2003. *Institutional, social, economic roots of deforestation: Further evidence of an environmental Kuznets relation?* http://web.uvic.ca/~kooten/Downloads/ Deforestation.pdf (7 Dec. 2003).

Mihm, Christopher. 2001. Implementing GPRA: Progress and challenges. In *Quicker better cheaper?: Managing performance in American government*, ed. Dall W. Forsythe. Albany, New York: Rockefeller Institute Press.

Millar, Jayne. 2002. *The ability of the Maldives to cope with freshwater scarcity via the adaptive capacity of its political economy*. Occasional Paper No. 44. School of Oriental and African Studies, University of London.

MOCIE (Ministry of Commerce, Industry and Energy). 2004. *2003 nyon suchulib siljeok pyungga bodojaryo* (New briefing on evaluation of export and import achievements in 2003). 1 January 2004. Seoul, South Korea.

MOCT (Ministry of Construction and Transportation). 1980. *Sujawon janggi jonghap gibon gyehoik:1981-2001* (The water resources development long-term plan: 1981-2001). Seoul, South Korea.

MOCT (Ministry of Construction and Transportation). 1999. New briefing.

MOCT (Ministry of Construction and Transportation). 2001a. *Dam gunsul janggi gyehoik, 2001-2011* (The dam construction long-term plan, 2001-2011). Korea.

MOCT (Ministry of Construction and Transportation). 2001b. *Sujawon janggi jonghap gyehoik* (Water Vision 2020). Seoul, Korea.

MOCT (Ministry of Construction and Transportation). 2001c. *Gonggong gunsul saup eui sajeon hwankyungsung pyungga chegye goochuk bogoseo* (A new deal for large-scale public construction projects in Korea: guidance on the new approach to Pre-Environmental Appraisal). Seoul, South Korea.

MOCT (Ministry of Construction and Transportation). 2003. *Mul ae kwanhan kookmin yeoron josa* bogoseo (Survey report of public consciousness on water). Korea.

MOCT (Ministry of Construction and Transportation). 2004. *Bodojaryo: Mulgwanri jeongchak hyubeuiche sulchi wunyoung* (News release on establishment and operation of Water Management Policy Committee between MOCT and MOE). 25 February 2004. Seoul, South Korea.

MOE (Ministry of Environment). 2003a. *2003 nyondo hwnakyung bojeon sichak chujin sanghwang bogoseo* (The 2003 follow-up report of environmental conservation measures).

MOE (Ministry of Environment). 2003b. *Hwankyung bojeon ae kwanhan kookmin euisik josa* bogoseo (Survey report of the public consciousness on environmental conservation).

MOE (Ministry of Environment). 2003c. *Hankook eui sanghasudo jeongchak* (Waterworks and sewerage policies in South Korea), article presented to the seminar held by the United Kingdom Embassy in South Korea. October 2003.

MOE (Ministry of Environment). 2003d. *Segye muleui hae jaryojib* (Databook of international water year). Seoul, South Korea.

MOE (Ministry of Environment). 2003e. 2003 *Hwankyung baekseo* (The white paper on the environment for 2003). Seoul, South Korea.

MOE (Ministry of Environment). 2003f. *Jayeon sangtae bokwon woosu sarye: Daepo cheon* (Good examples for recovering national ecology: Daepo stream). South Korea. http://www.me.go.kr/user/management/man_data_detail.html?av_inpymd =20030519094544&av_code=12 (27 Dec. 2003).

MOE (Ministry of Environment). 2003g. *Jayeon sangtae woosu maeul mit bokwon woosu sarye seonjeong jichim* (The guideline for selecting good examples of local communities for preserving and recovering national ecology). South Korea.

MOGH (Ministry of Government Administration and Home Affairs). 2002. *OECD gukga eui jeongbu inreok bigyo* (Comparison of government human resources in the OECD countries). Seoul, South Korea.

Moreau, David. 1998. A giant step backward. *Water Resources Update* 110: 9-12.

Morris, J. 1998. Water policy: Economic theory and political reality. In *Water: Economics, management and demand*, eds. Melvyn Kay, L. Smith, and T. Franks. London: E F & N Spon.

MPB (Ministry of Planning and Budget). 2003. *Annual major financial indicators*. Seoul, South Korea. http://www.mpb.go.kr/hp10004ht/hp10016ht01.html (1 Dec. 2003).

NRC (National Research Council). 1999a. *New directions in water resources planning for the U.S. Army Corps of Engineers*. The National Academy Press.

NRC (National Research Council). 1999b. *New strategies for America's watershed*. The National Academy Press.

NRC (National Research Council). 2002. *Review procedures for water resources project planning*. The National Academy Press.

NWC (National Water Commission). 1973. *Water policies for the future*. Government Printing Office.

OECD (Organization of Economic Co-operation and Development). 1989. *Water resource management: Integrated policies*. Paris, France.

OECD (Organization of Economic Co-operation and Development). 2002. *Highlights of public sector pay and employment trends: 2002 update*. Paris, France.

Oh, John Kie-chiang. 1999. *Korean politics: The quest for democratization and economic development*. Ithaca: Cornell University Press.

Oh, Moon-Hwan. 2000. Sawhoi undong juche eui teuksung (The characteristics of the core power of social movement). *The 21st Century Political Science Review* 10, no. 2. Seoul, South Korea.

Ohlsson, Leif. 1999. *Environment, scarcity and conflict: A study of Malthusian concerns*. Ph.D. dissertation, Sweden: University of Goteborg.

Olsen, Asger. 2002. *The new water framework directive: prospects for sustainable water policy for the coming decades.* http://www.us.es/ciberico/ciphn/pdf/olsen.pdf (17 Nov. 2003).

Ongley, Edwin. 2001. Water quality programs in developing countries: design, capacity building, financing, and sustainability. *Water International* 26, no. 1: 14-23.

Ostrom, Elinor. 1990. *Governing the commons: The evolution of institutions for collective action.* United Kingdom: Cambridge University Press.

Palmer, Tim. 1996. *America by rivers.* Island Press.

Park, In-Yong. 2002. *sujaweon gaebal saup eui jeongchak buleung ae daehan yeongu* (A study of policy noncompliance on water). Ph.D. diss., Kookmin Univ. South Korea.

Park, Sung-Chul. 2001. Hwankyung issue ae daehan hwankyung danche eui media euije suljeongryuk ae daehan yeongu (An analysis of agenda setting power of environmental group on environmental issues). *Eonron Munhwa Yeongu* (The Media Culture Research) 17. Seoul, South Korea.

Park, Sung-Je and Jaeeung Yi. 2001. Youngwol dam galdeungeui jeongchihak (The politics of Youngwol Dam dispute). *Magazine of Korea Water Resources Association* 34, no. 5. Seoul, South Korea.

Park, Sung-Je and Jaeeung Yi. 2003. Mulgwanri cheje gaesun eul wihan yeogeon gwa insik (The condition and awareness for reforming Korean water governance). *Magazine of Korea Water Resources Association* 36, no. 4. Seoul, South Korea.

Park, Sung-Je, Seok-Young Yoon and Dong-Ryul Lee. 2000. Miguk sujawon jeongchak eui byunkyung gwajeong gochal (Review of water policy change process in the United States). *Magazine of Korea Water Resources Association* 33, no. 3. Seoul, South Korea.

PCSD (Presidential Commission on Sustainable Development). 2003a. *Jisok ganeung han mulgwanri cheje gaesun eul wihan gongcheongwhoi* (The public hearing for water governance reform for a sustainable development in South Korea), The PCSD public hearing databook, April 8, 2003, Seoul, South Korea.

PCSD (Presidential Commission on Sustainable Development). 2003b. *Jisok ganeung han mulgwanri cheje gaesun eul wihan gongcheonghoi gyeolgwa* (The result report of the public hearing for water governance reform for a sustainable development in South Korea), The PCSD public hearing record, April 8, 2003, Seoul, South Korea.

Pitman, George. 2002. *Bridging troubled waters: Assessing the World Bank water resources strategy.* The World Bank.

Reisner, Marc. 1993. *Cadillac desert: The American west and its disappearing water.* revised and undated version. Penguin Books.

Rhee, Jeong-jeon and Hoi-Seong Jeong. 2003. Hankook hwankyung jeongchak eui baldal dongin (Dynamics of environmental policy development in Korea: how did the policy windows have been opened?). *Hwankyung Jeongchak Yeonkoo* (Environmental Policy Research) 2, no. 1. Korea Environment Institute.

Rhodes, R.A.W. 1997. *Understanding governance: policy networks, governance, reflectivity and accountability*. Open University Press.

Rogers, Peter and Alan W. Hall. 2003. *Effective water governance*. TEC Background Paper No. 7. Global Water Partnership.

Rogers, Peter. 1993. *America's water: Federal roles and responsibilities*. The MIT Press.

Sabatier, Paul and Hank Jenkins-Smith. 1993. *Policy change and learning: An advocacy coalition approach*. Westview Press.

Saleth, Maria and Ariel Dinar. 1999. *Evaluating water institutions and water sector performance*. World Bank Technical Paper No. 447. The World Bank.

Salisbury, Robert. 1968. The analysis of public policy: A search for theories and roles. In *Political science and public policy*, ed. Austin Ranney. Chicago: Markham.

Salman, Salman M.A. 2001. Sharing rivers for peace, development, and security: Analysis of the recommendations of the World Commission on Dams. *Water International* 26, no. 2: 283-288.

Salman, Salman M.A. 2003. From Marrakech through The Hague to Kyoto: Has the global debate on water reached a dead end? part one. *Water International* 28, no. 4: 491-500.

Salman, Salman M.A. 2004. From Marrakech through The Hague to Kyoto: Has the global debate on water reached a dead end? part two. *Water International* 29, no. 1: 11-19.

Savenije, H.H.G. 2001. *Water resources management concept and tools*. Delft, The Netherlands: IHE.

Schultz, Gert A. 1998. A change of paradigm in water sciences at the turn of the century?. *Water International* 23, no. 1: 37-44.

Serageldin, Ismail. 1995. Water resources management: A new policy for a sustainable future. *Water International* 20: 15-21.

Sharrock, Wes and Rupert Read. 2002. *Kuhn: philosopher of scientific revolution*. UK: Polity Press.

Shin, Dong-Ho. 2004. Environmentalist Yul Choi 'Life reversal.' *The Newsmaker* 571, April. Seoul, South Korea.

Song, Young-Joo. 2000. *Hwankyung jeongchak gyuljeong gwajeong aeseoeui NGO yeokhal bunseok* (A study of NGO's role in the process of the environmental decision making). Master thesis, Yonsei University. Seoul, South Korea.

Sweetser, Lindsay. 1994. *An economic comparison for Two Forks and its alternatives*. Master thesis, Colorado State University.

Szöllösi-Nagy, András. 2004. *Water interactions: Systems at risk - what can the science of hydrology do?* Paper submitted to the Hydrology Days, March 10, 2004. Colorado State University.

Tesh, Sylvia. 1999. Citizen experts in environmental risk. *Policy Sciences* 32: 39-58.

Turton, Anthory R and Leif Ohlsson. 1999. *Water scarcity and social stability: Towards a deeper understanding of the key concepts needed to manage water scarcity in developing countries*. Occasional Paper No. 17. School of Oriental and African Studies, University of London.

Turton, Anthory R. 1999. *Water scarcity and social adaptive capacity: Towards an understanding of the social dynamics of water demand management in developing countries*. Occasional Paper No. 9. School of Oriental and African Studies, University of London. http://www2.soas.ac.uk/Geography/WaterIssues/OccasionalPapers/AcrobatFiles/OCC09.PDF (7 May 2003).

Turton, Anthory R. 2000. *Water and sustainable development: A Southern perspective.* African Water Issues Research Unit, Pretoria University. South Africa.

Turton, Anthory R. 2003. *Towards hydrosolidarity: Moving from resource capture to cooperation and alliances.* African Water Issues Research Unit, Pretoria University. South Africa.

TVA (Tennessee Valley Authority). 1999. *Strategic plan FY2000-2005*. http://www.tva.gov/abouttva/corporaereport.htm (25 Mat 2003).

TVA (Tennessee Valley Authority). 2002a. *2001 Performance result*. http://www.tva.gov/ abouttva/corporaereport.htm (25 Mat 2003).

TVA (Tennessee Valley Authority). 2002b. *2003 Annual plan*. http://www.tva.gov/abouttva/ corporaereport.htm (25 Mat 2003).

UNESCO. 1999. *Sustainability criteria for water resource systems*. UK: Cambridge University Press.

UNESCO. 2003a. *Water for people water for life*. The World Water Development Report. World Water Assessment Programme.

UNESCO. 2003b. *Water for people water for life*, executive summary. The World Water Development Report. World Water Assessment Programme.

University Microfilms International. 1987-1991. *The Denver Post Index*. Ann Arbor, Michigan: Bell & Howell International Company.

USCB (U.S. Census Bureau). 2002, 2000, 1995. *Statistical abstract of the United States.*

van Hofwegen, Paul and Frank Japsers. 1999. *Analytical framework for integrated water resources management: Guideline for assessment of institutional frameworks*. Rotterdam, Netherlands: A.A. Balkema Publishers.

Viessman, Warren Jr. 1998. Water policies for the future: An introduction. *Water Resources Update* 111: 4-7.

WCD (World Commission on Dams). 2000. *Dams and development: A new framework for decision-making*. Earthscan Publications Ltd.

WCED (World Commission on Environment and Development). 1987. *Our common future*. UK: Oxford University Press.

Wilds, Leah (1988). *Organizational behavior in the implementation of environmental water policy*. Ph.D. dissertation, Colorado State University, Fort Collins, USA.

Winograd, M., M. Aguilar, and A. Farrow. 1999. *Conceptual framework to develop and use water indicators*. Technical Note. CIAT: Cali, Colombia.

Winpenny, J.T. 1998. Demand management for efficient and equitable use. In *Water: Economics, management, and demand*, eds. Melvyn Kay, L. Smith, and T. Franks. London: E F & N Spon.

World Bank. 1992, 1996. *The world development report.* Washington, D.C.

World Bank. 1993. *Water resources management: A World Bank policy paper.*

World Bank. 2003. *The world development report 2003: sustainable development in a dynamic world.* Washington, D.C.

World Economic Forum and Yale University. 2002. *Environmental performance measurement: The global report 2001-2002*. Oxford University Press.

WWAP (World Water Assessment Programme). 2001. *Water security: A preliminary assessment of policy progress since Rio*. Paris.

WWC (World Water Council). 2000a. *World water vision: Making water everybody's business*. Earthscan Publication Ltd.

WWC (World Water Council). 2000b. *Final report of second world water forum and ministerial conference.*

WWC (World Water Council). 2000c. *World water vision commission report: A water secure world.* Marseille, France.

Yashai, Y. 1992. From iron triangle to iron duet: Health policy making in Israel. *European Journal of Political Research* 21: 91-108.

Youn, Doo-Hwan. 2003. *Bodojaryo* (News briefing on the parliamentary inspection of KOWACO). 25 September 2003. Office of Representative Doo-Hwan Youn of the National Assembly. Seoul, South Korea.

Zaslowsky, Dyan. 2000. Water development turns a corner. In *Water in the West*, ed. Char Miller. Oregon State University Press.

LIST OF ABBREVIATIONS

AEIA	Act on Environmental Impact Assessment
AIETD	Act on Assessment of Impacts of Works on Environment, Traffic, Disaster, etc.
BCA	Benefit–cost analysis
BLM	United States Bureau of Land Management
BOR	United States Bureau of Reclamation
COE	United States Army Corps of Engineers
CPQSFR	Commission on Protection of the Quality and Supply of Freshwater Resources
CWA	Clean Water Act
DOI	United States Department of Interior
DOT	United States Department of Transportation
DWB	Denver Board of Water Commissioners (Denver Water Board)
DWD	Denver Water Department
DWM	Demand-side water management
East Slope	The east side of the Continental Divide
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statements
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
EU	European Union
FAEP	Framework Act on Environmental Policy
GWP	Global Water Partnership

HDI	Human Development Index
ICWE	International Conference on Water and Environment
IRP	Integrated Resources Planning
IT	Information technology
IWA	International Water Association
IWRM	Integrated Water Resources Management
Joint Task Force or JTF	Joint Task Force for Comprehensive Feasibility Study on Youngwol Dam
KFEM	Korean Federation of Environmental Movement
KOWACO	Korea Water Resources Corporation
MOAF	Ministry of Agriculture and Forestry
MOCIE	Ministry of Commerce, Industry and Energy
MOCT	Ministry of Construction and Transportation
MOE	Ministry of Environment
MOGH	Ministry of Government Administration and Home Affairs
MWP	Metropolitan Water Providers
NEPA	National Environmental Policy Act
NID	National Inventory of Dams
NWMC	National Water Management Committee
OECD	Organization for Economic Cooperation and Development
PCSD	Presidential Commission on Sustainable Development
Pre-EA	Pre-Environmental Appraisal
RBWMCs	River Basin Water Management Committees
Roundtable	Colorado Governor's Roundtable

SAC	Social adaptive capacity
SEIS	System-wide Environmental Impact Statement
SWM	Supply-side water management
SWSI	Social Water Stress Index
TMDL	Total maximum daily load
TVA	Tennessee Valley Authority
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCHE	United Nations Conference on Human Environment
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USFS	United States Forest Service
WCED	World Commission on Environment and Development
West Slope	The west side of the Continental Divide
WFD	Water Framework Directive
WPCC	Water Policy Coordination Committee
WRC	United States Water Resource Council
WRPA	Water Resources Planning Act
WWAP	World Water Assessment Programme
WWC	World Water Council
WSI	Water Stress Index
WWDR	World Water Development Report
WWV	World Water Vision