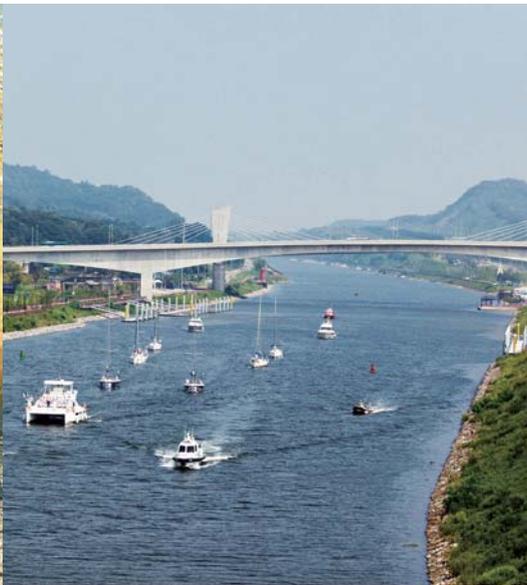


WATER AND GREEN GROWTH

Beyond the Theory for Sustainable Future



VOLUME I | 2015



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About the Report

This report has been prepared as a final edition of the Water and Green Growth Project, a collaborative research by the Government of Korea, as represented by the Ministry of Land, Infrastructure and Transport and K-water, and the World Water Council.

Disclaimer

This report is an output of the staff of Research Center for Water Policy and Economy at K-water Institute. The findings, interpretations, arguments, and conclusions expressed in this report do not necessarily reflect the views of the Korean Government, K-water, and the World Water Council.

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WATER AND GREEN GROWTH

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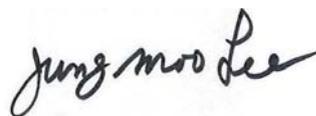
by Chair of the National Committee for the 2015 World Water Forum Korea

As the president of the National Committee for the 2015 World Water Forum Korea, it gives me a great pleasure to announce the publication of the *Water and Green Growth: Beyond the Theory for Sustainable Future* at the 7th World Water Forum held in Daegu·Gyeongbuk, Republic of Korea.

The Water and Green Growth provides the results of a joint international research of the World Water Council and the Korean government, to emphasize the role of water and its importance in achieving goals of green growth. This project has been carried out from the initial stages of the 7th World Water Forum, in which I am happy to be involved directly and indirectly. It is our hope that launching of this report at the 7th World Water Forum, the largest global water event for experts, decision makers, and stakeholders, will open up the pathway of a new global paradigm towards sustainable development.

The Water and Green Growth initiative, led by the Korean government, is in the process of developing into a new global paradigm. The concept was first introduced in the 6th World Water Forum in Marseille, France in 2012 and went through various discussions and development at different levels and platforms since then. This year, it has been selected as one of the main topics in the Thematic Process in the 7th World Water Forum. This is the opportunity to let the world know that water is central to environmentally sound and socially inclusive, economic development.

Let us remember that this is only the beginning of better solutions, for better lives. I would like to congratulate and thank the WGG Team on the completion of this research. Finally, I hope that the participants will enjoy and make the most out of their time here in Daegu·Gyeongbuk.



Jung-moo Lee



by Chief Executive Officer of K-water

I would like to express my sincere gratitude to the research members of the Water and Green Growth Project from the World Water Council, the Republic of Korea and other case countries. The contributions of the OECD, ADB, World Bank, UNEP, and ESCAP should not be valued lightly. Thanks to their devotion, Water and Green Growth has been prioritized on the global agenda in order to achieve our common goal, sustainable development.

The Water and Green Growth report puts forward green growth as the new strategy for sustainable development. Many countries have started focusing on green growth as a solution to tackle prolonged economic, environmental, and social crises. The United States has been promoting the Green New Deal to foster investment in green industry. Germany, France, the UK, and other European countries have joined the trend to achieve green growth by investing in the alternative and renewable energy industries.

I strongly believe that the Smart Water Management Initiative (SWMI) can champion technological solutions for Water and Green Growth. The SWMI is a new instrument that integrates information and communication technology in all processes of water management, from source to tap. The SWMI can maximize the efficiency and effectiveness of water supply and sanitation by saving energy, reducing costs, and most importantly, meeting consumers' needs and wants. The SWMI can minimize economic, social, and environmental risks caused by water-related disasters by accurately monitoring and anticipating the disasters and optimally systemizing infrastructures.

Our world is still far from addressing the water-related challenges, especially for those in dire need. Due to the effects of climate change and other global crises, these problems will only be exacerbated unless immediate action is taken. It is my fervent hope that technical innovation based on SWMI will accelerate our efforts to realize Water and Green Growth. I deeply appreciate the publication on Water and Green Growth and confidently expect that through our efforts monumental achievements will be gained in the not-so-distant future.

Choi gyu woon

Gyewoon CHOI



by President of the World Water Council

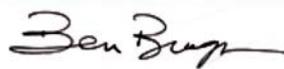
We all accept that water is important to human well-being. However, the vital role that water plays in national economic development is less clear. Yet, this is changing. Driven by the scale of impact, both positive and negative, water now represents the number one risk in terms of impact on our global society. We are also keenly aware that the growing demand for water is rapidly outstripping our ability to supply it. As a result, governments today face growing challenges in advancing economic and social development in view of resource constraints, risks posed by climate change, and environmental degradation.

In recent years these resource constraints have challenged contemporary development models, and new paradigms such as Green Growth have emerged. For many, a path towards inclusive Green Growth, featuring resource-efficient and climate-resilient economic development and poverty reduction, has become a necessity rather than a choice.

This report investigates the role that water can play as an engine for Green Growth. It highlights the opportunities and innovations in water resources management that can support sustainable economic growth. Adopting these strategies will help meet soaring demands for food, transport, housing, energy and water in a socially, economically and environmentally sound way. Governments must now show their leadership in privileging the implementation of specific water-centered approaches to Green Growth, combining state-driven policies, market-oriented strategies and community-centered actions.

Through its long-standing partnership with the Korean Government, the World Water Council has found a valuable ally to pursue a global policy agenda that puts water at the heart of sustainable social and economic development that also safeguards the environment. Experience demonstrates that investment and financing are critical if we are to bridge the gap between water demand and supply, and between the ambition of the wider political economy and the technical expertise of the water community. Put simply, at a global scale, we are not investing enough or in the right way to bridge the gap. More needs to be done to leverage water investments for the greater global good.

This report offers ideas for future pathways that will strengthen the relationship between Water and Green Growth. Our collective challenge is to take these ideas, develop them, and take action to create a better tomorrow.



Benedito Braga



MESSAGES FROM THE STEERING COMMITTEE MEMBERS



Doğan Altınbilek
WWC, Co-chair

It was my pleasure to co-chair Steering Committee of “Water and Green Growth” study which highlights the role and cross cutting nature of water to achieve sustainable development. I believe that in the context of the post-2015 SDGs, this report with its policy guideline and case studies will be an important reference for policy makers and researchers both in developed and developing countries alike. I would like to extend my most sincere thanks to all who contributed to this project.



Karin Krchnak
World Wildlife Fund

We are at a critical point for freshwater: This year, the World Economic Forum’s global risk report identified water crises as the top global risk in terms of impact, and the Living Planet Report revealed that freshwater species are declining at an average rate of 76% percent—much faster than their terrestrial or marine counterparts. These findings underscore the importance of conversations governments are having around water as part of the Sustainable Development Goals (SDGs), which will set the development trajectory for the next 15 years. The SDGs aim to fill the gap from the Millennium Development Goals, but more importantly they have the potential to align developed and developing countries alike on a path towards a more sustainable future. Across sectors, water is finally on the agenda, and governments, businesses, and civil society organizations around the world are seeking solutions that balance water and growth. I am honored to have been part of the Water and Green Growth Project from the very beginning and believe it is a significant contribution to current dialogues on water. Together, we can encourage global-local decisions and actions that ensure water as the foundation for a healthier and viable planet, and the Water and Green Growth Report will be a valuable tool for that.



Mark Smith
IUCN

Many are talking about the idea of green growth and trying to understand how to make it practical, how to create policies that can set a path for economic growth and development that is green. Any way forward for green growth will demand good collaboration. This is how we will learn how green growth works. The collaboration between the Korean government and World Water Council on Water and Green Growth has been one such collaboration. The report from this project, to be launched at the 7th World Water Forum, shares our joint learning on green growth. Our hope is that these lessons and our recommendations for policy will inspire readers to recognize that a greener world is made possible with efficient and sustainable management of water.



Charles-Louis de Maud'huy
Société des Eaux de Marseille

Congratulations on reaching the finish line! The report is quite unique as the research sought for solutions that are generally applicable but at the same time, respects different contexts and particularities of countries that have and will strive towards green growth. For a long time, we have been reiterating the importance of water and its relation to the political, economical, environmental worlds, and the society at large. However, this is one of the first reports to discuss the role of water in achieving the goals and interests of all the four sectors at the same time. I would like to use this opportunity to acknowledge and thank everyone who contributed to the success of the WGG Project.



Kyung-Jin Min
K-water, Co-chair

Thanks to the efforts of many committed and ardent people, the challenges of the Water and Green Growth (WGG) research were overcome and a clear vision has been set. The focus of this research was set up on an analytical basis to enhance communication and to perform in-depth case studies which can be showcased. Nonetheless, lowering oil price and deepening economic difficulty could hinder the rapid realization of the WGG. This is the time to devote ourselves to our shared vision, the WGG.



Yang Jin Oh
The National Committee for
the 2015 World Water Forum

First, I'd like to congratulate K-water on the successful completion of the research on Water and Green Growth. It has been the happiest moments of my life being on a journey for the research with the distinguished members of the Steering Committee. Every process of the research was completely new and a wonder to me since I am not from academia but from the government. It was an honor and unforgettable memory for me to work with the SC members. And lastly, I'd like to express a deep appreciation to the SC members and K-water for their hard work and devotion which they have provided until today.



Deuk Koo Koh
Korea Water Forum

Congratulations on the successful completion of the Water and Green Growth Project and on the publication of the final report. This report will surely guide the future projects and research on the application and implementation of the green growth concept in the water-related field. It was a long journey to find out the sensible and robust definition of green growth and to provide good case studies for those who are exploring the new development concept at home countries. My sincere appreciation goes to those endeavor and enthusiasm of the Project Team, authors, and honorable Steering Committee members.



Soojin Kim
K-water

It is my distinct pleasure to deliver a congratulatory message for the Water and Green Growth Final Report. I would like to extend my sincere thanks to all of the SC members and other colleagues who were involved in the WGG Project from the Phase 1 up to now. With efforts and cooperation of all members, the WGG Project at last has come to an end. It was not an easy project, but I am grateful to have been part of it. It is my hope that Water and Green Growth is continued on the global agenda leading our world to a sustainable future.

A young child, wearing a white headscarf and a dark, long-sleeved garment, stands in a makeshift shelter. The shelter is constructed from rough, weathered materials, possibly mud or plaster, with visible cracks and peeling. The child is looking down, and the overall scene is dimly lit, suggesting a poor living environment. The entire image is overlaid with a semi-transparent blue filter.

EXECUTIVE SUMMARY

Executive Summary

This report, *Water and Green Growth: Beyond the Theory for Sustainable Future*, launched at the 7th World Water Forum in Daegu-Gyeongbuk, Republic of Korea, builds on the initial work presented at the 6th World Water Forum in Marseille, France in 2012. This report presents the research conducted over the last four years, a new theoretical approach, a revised analytical framework and recommendations for policy makers to begin the process of implementing Water and Green Growth strategies. The Volume 1 also provides a recap of the history and rationale behind the development of the Water and Green Growth concept and the Project. It reiterates the importance of approaching water resources management in a way that contributes to economic growth, environmental protection, and socially-inclusive development.

What is Green Growth?

The concept of green growth (GG) emerged from the Republic of Korea in 2008, as in the words of former President, “a new national development paradigm for job creation and new growth by using green and clean technology”. International organizations that promoted the concept of green growth included the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Organisation for Economic Cooperation and Development (OECD). Green growth is also related to the concepts of *green economy* (UNEP) and *inclusive green growth* (World Bank) that emerged around the same time. As the green growth concept evolved in Korea and other countries around the world, it became clear that water was vital to green growth and to the three pillars of sustainable development – economic growth, environmental protection, and social development. Whilst efficient and sustainable management of water resources has been perceived as crucial to sustainable development, its role in attaining green growth has been rarely studied.

The Water and Green Growth Project

In this regard, the Republic of Korea and the World Water Council established the Water and Green Growth (WGG) concept and launched the WGG Project in 2010. The parties signed a Memorandum of Understanding for Phase 1 of the Project in November 2010 and established a Steering Committee (SC) to oversee the evolution of the project from 2010 to the present. The first edition of the WGG report was based on an analysis of 26 international case studies and was launched at the 6th World Water Forum (Marseille, March 2012). At that event, Korea was designated as the host of the 7th World Water Forum, and Water and Green Growth was subsequently identified as one of the major themes to be included in the 7th World Water Forum’s program.

The WGG Team is pleased to launch this report at the 7th World Water Forum in Daegu-Gyeongbuk, Republic of Korea in April 2015. The report is based on strategic, institutional, and evidence-based approaches and an additional 11 in-depth case studies during Phases 2 and 3 that were narrowed down from 26 short case studies in Phase 1. The two main partners of the WGG Project (Republic of Korea and World Water Council) are also the main sponsors of the World Water Forum itself. We appreciate the contributions of the many partners who were involved in the case studies or developing the WGG concept and look forward to sharing experiences with new partners who wish to embark on a Water and Green Growth path. It is important to mobilize international support, as in 2012, so that the lessons can be transferred across borders during the post-2015 period, leading to the 8th World Water Forum in 2018.

Three Approaches Applied for the Deep Understanding on WGG

A strategic approach for WGG presented in the Phase 1 was based on the three dimensions of sustainable development: economic (Water as an Engine for Growth); environmental (Protection and Conservation of Water Resources); and social (Water for an Improved Quality of Life). Four policy directions under each of the three strategic dimensions were suggested. This strategic approach was applied to 26 brief case studies in which successful water-related policies and instruments were suggested.

In Phases 2, research has employed institutional approach. The institutional approach was developed to analyze the relationships and interactions among exogenous factors, relevant institutions, and the performance of projects or programs. The institutional approach sheds light on various policy mixes consisting of the state-driven, market-oriented, and community-centered institutions and policy instruments.

Eleven cases from 10 countries were analyzed in-depth using the institutional approach (the analytical framework). The 11 case studies evaluated for this report were selected by the Steering Committee to supplement the earlier work on 26 case studies, to explore the role of water in green growth and to enhance green growth policies as shown in Box 1-1 (p.35). The analysis included an investigation into the exogenous factors that influenced the case—the economic, social, political, environmental, and technological contexts—in which water projects took place. These factors also had an impact on the policies and institutions that marked the project's course from its planning stage to the present and on the changes in those policies and institutions over time. The WGG Team examined the exogenous and endogenous factors, and then considered the institutional and policy factors together. Finally, the team conducted detailed quantitative and qualitative analyses of performance based on 20 questionnaires and five interviews for each study, in order to identify policy implications. The in-depth research provided empirical evidence for the policy guideline and the rationale for WGG.

Each of the cases is complex in nature and demonstrates diverse policy and institutional aspects. All generally conform to criteria related to the role of water within economic growth, environmental protection, and social development objectives. The respondents to the survey questionnaires were experts and stakeholders with knowledge of the WGG Project who assessed the performance level across each of these three dimensions (Volume 2).

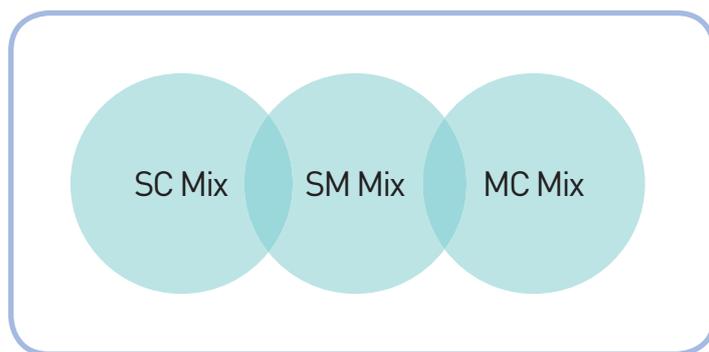
Key Messages from Case Study Analysis

Water and Green Growth proves to be applicable worldwide and can be especially valuable to developing countries as a pathway to achieve sustainable development in an accelerated way. Several key messages have been extracted from the analysis of the case studies (p.13).

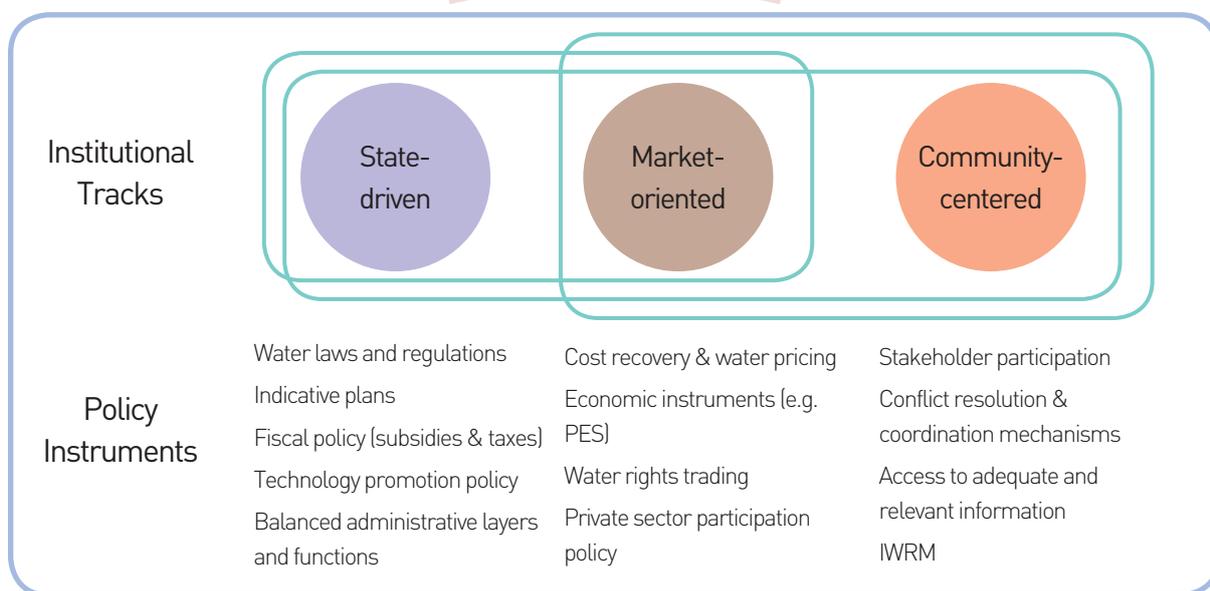
Application of the Research

This research intends to show practical ways towards WGG for all participants in water projects or programs from policy makers, local government officials, business leaders, and civil society activists. Politicians and high ranking officials may deliberate which type of policy mixes will be appropriate in their contexts, how key players can be motivated and coordinated, and how critical resources can be mobilized. Entrepreneurs are mainly interested in economic gains and risks. Non-governmental organizations (NGOs) are generally concerned about the environmental and social impact of projects or programs. These interests should be harmonized for the success of WGG, given a specific context. The in-depth case studies based on the institutional approach take into consideration the state, the market, and community actors. The report provides performance results and implications for stakeholders.

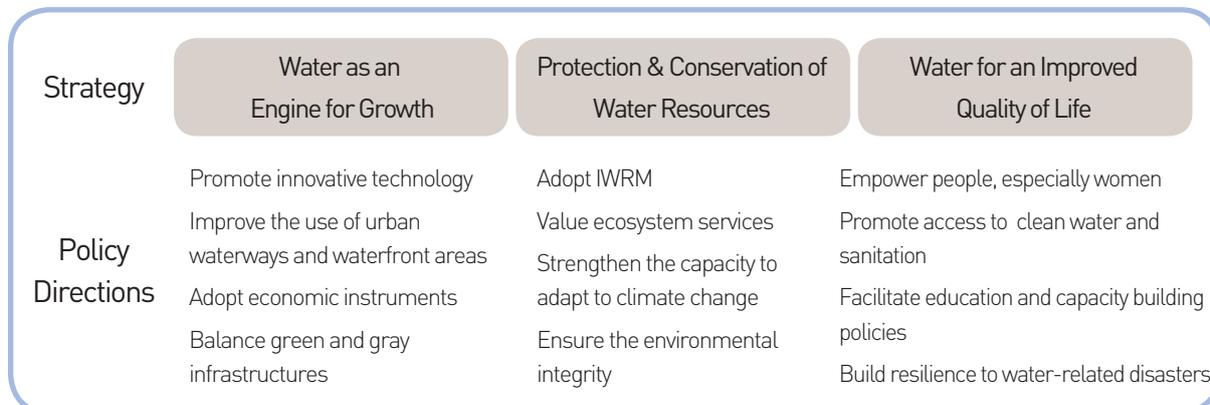
The Policy Mix



The Policy Roadmap
:To select an appropriate Policy Mix



The Policy Guideline (Modified from the policy framework in the Phase 1)



Overview of the Water and Green Growth Research

Key Messages

- ▶ Water is a vector through which green growth can occur.
- ▶ There is no one-size-fits-all strategy.
- ▶ A holistic approach to encompass three pillars of sustainable development is essential.
- ▶ Strong political leadership and commitment are essential.
- ▶ Indicative planning tools can be used by governments or basin organizations to promote holistic economic and social development through sustainable management of water resources and maintenance of related infrastructure to improve ecosystems.
- ▶ A clear legal framework supports Water and Green Growth projects in terms of consistency and continuity.
- ▶ Better coordination, with clearly defined responsibilities among actors, is needed for improved water management.
- ▶ Policies that support innovation and technology and foster R&D investment can improve water management.
- ▶ Increased investment dedicated to developing sustainable water services and infrastructure will yield high economic, environmental, and social returns.
- ▶ Economic instruments can be used as effective measures to safeguard environmental sustainability.
- ▶ Well-defined water rights for both surface and groundwater are crucial to effective water management.
- ▶ Stakeholder participation is valuable for reflecting the community interest, building support, and for conserving and protecting water resources.
- ▶ Educational programs and capacity building can increase environmental awareness and increase functional effectiveness of overall water resources governance.
- ▶ Enhanced water and data information can provide essential decision support for effective water management.

This shows an overview of the Water and Green Growth research. The concept of Water and Green Growth aims to achieve sustainable development with three strategies: 1) Water as an Engine for Growth; 2) Protection and Conservation of Water Resources; and 3) Water for an Improved Quality of Life. Each strategy includes a list of policy directions which fall under three strategies. The policy guideline is modified from the policy framework in Phase 1. After conducting in-depth case studies in Phases 2 and 3, some policy directions were revised and developed further.

While water-related challenges cannot be addressed with a single policy instrument due to different socio-economic context of each country, the WGG Team analyzed the relationships and interactions among exogenous factors (e.g. economic, social, political, environmental and technical factors), institutions, and performances of the project and categorized Water and Green Growth institutions into state-driven, market-oriented, and the community-centered institutions. These three groups are categorized based on relevant principles that institutions follow and drivers of institutional changes.

Different types of institutional tracks should be selected and tailored to a state's context and development objectives. In this regard, the policy mix is developed and defined as "a set of institutions and policy instruments that are set up and implemented as a function of complex socio-political and economic contexts related to water resources". There has been a wide a range of policy mixes, but the WGG Team focused on the three types of policy mix based on the results of the analyses. These are SM, MC and SC Policy Mix (State-driven + Market-oriented Policy Mix: SC Mix, Market-oriented +Community-centered Policy Mix: MC Mix, and State-driven+Community-centered Policy Mix: SC Mix) (see Chapter 5).

To select an appropriate policy mix for each country, policy decision makers should follow the 4-steps in policy implementation roadmap (see Chapter 5). This is a step-by-step tool to help policy makers achieve sustainable development.

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Abbreviations

- ADB** Asian Development Bank
- AfDB** African Development Bank
- AFRE** Asociación de Fabricantes de Agua y Riego Espanoles
- AHRE** Andhikhola Hydel and Rural Electrification
- BOD** Biochemical oxygen demand
- BPCL** Butwal Power Company Limited
- CHE** Ebro River Basin Confederation in Spain (Confederación Hidrográfica del Ebro)
- EMG** UN Environmental Management Group
- FAO** Food and Agriculture Organization of the United Nations
- FDI** Foreign direct investment
- GCF** Green Climate Fund
- GGGI** Global Green Growth Institute
- IPCC** Intergovernmental Panel on Climate Change
- IUCN** International Union for Conservation of Nature
- ISKI** Istanbul Water Sewerage Administration (Turkey)
- IWRM** Integrated water resources management
- IWRP** Integrated Water Resources Plan (Egypt)
- K-water** Korea Water Resources Corporation
- KWF** Korea Water Forum
- MDBA** Murray-Darling Basin Authority (Australia)
- MDGs** Millennium Development Goals
- MLTM** Ministry of Land, Transport and Maritime Affairs, Republic of Korea (succeeded by MOLIT)
- MOCT** Ministry of Construction and Transportation, Republic of Korea (succeeded by MLTM)
- MOLIT** Ministry of Land, Infrastructure and Transport, Republic of Korea
- NGO** Non-governmental organization
- ODA** Official Development Assistance
- OECD** Organisation for Economic Cooperation and Development
- PCGG** Presidential Committee on Green Growth (Korea)
- PCJ** Piracicaba, Capivari, and Jundiaí River Basins (Brazil)
- PES** Payment for ecosystem (or environmental) services
- PPP** Public-private partnership

SAIH Hydrological Information System (Spain)

SCM Stakeholders Consultation Meeting (SCM)

SEM Société des Eaux de Marseille (SEM)

UN United Nations

UNCED United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, June 1992
(also known as the Earth Summit and the Rio Summit)

UNCSD United Nations Conference on Sustainable Development (also known as Rio+20 and the Earth Summit 2012)

UNESCAP United Nations Economic and Social Commission for Asia and the Pacific

UNESCO United Nations Educational, Scientific, and Cultural Organization

UNFCCC United Nations Framework Convention on Climate Change

WCED World Commission on Environment and Development (Brundtland Commission)

WEF World Economic Forum (also known as the Davos Forum)

WFD European Union's Water Framework Directive

WGG Water and Green Growth

WHO World Health Organization

WWC World Water Council

WWDR World Water Development Report

WWF World Wildlife Fund

WWFKNC National Committee for the 7th World Water Forum (Korea)



CHAPTER 1

INTRODUCTION

This chapter delineates global water challenges we are facing and provides a brief introduction of the concept, Water and Green Growth and the Project. Rapid economic growth, unsustainable business-as-usual and unpredictable climate change have increased the level of global water consumption over the last few decades and have put water at a greater risk. In such regard, in response to conventional growth patterns, the green paradigm has emerged as a solution to address water-related challenges, and, indeed, global development as a whole.

The Water and Green Growth paradigm can transform the historical behavior of polluting and degrading the environment first and then cleaning up and restoring the environment afterward toward cleaner and inclusive development. Adopting the Water and Green Growth concept for sustainable development results in economic growth that is both environmentally and socially sound.

1.1 Water-related Challenges

Global Water Challenges

In 2000, 189 member countries of the United Nations gathered and established the 8 Millennium Development Goals (MDGs) together with 21 targets, which should be achieved by the year 2015. Among the 8 goals, Goal 7 highlights environmental sustainability with 4 targets. In particular, Target 7.C is to reduce by half the proportion of the population without sustainable access to safe drinking water and basic sanitation by 2015. According to estimations, the MDG drinking water target had been reached in 2010, indicating that over 2 billion people gained access to improved water sources from 1990 to 2010. The target was met five years ahead of the original schedule.

While progress has been made globally, 45 countries are still not on track to meet water and sanitation target under the MDGs by 2015. Formidable challenges still remain, such as huge disparities and incomplete information about drinking water safety for global monitoring (WHO and UNICEF, 2012). Based on the latest UN MDGs Report in 2014, 748 million still relied on unsafe drinking water in 2012, and 173 million were drinking water directly from local water sources. The performance of the MDG target on access to improved sanitation lags far behind.

The foundation for the Sustainable Development Goals (SDGs) was laid in 2012 at the UN Conference on Sustainable Development (Rio+20), where Heads of State, the private sector, NGOs and other various civil society groups gathered in order to discuss how to reduce global poverty, ensure environmental sustainability, and social equity in the future. Giving attention to water as a pre-requisite for all dimensions of development will underpin and provide support to achieving all the SDGs, beyond simply those directly related to water and sanitation. Furthermore, water should not be dealt solely and requires a cross-sectoral approach.

With the global population projected to grow to 9.2 billion by 2050 (OECD, 2012), achieving SDGs and addressing water-related challenges may become more difficult. Growing population, urbanization, and rapid economic growth, along with climate change have accelerated the level of global water consumption over the past few decades. In addition, climate change has led to the occurrence of unusually large-scale and more frequent water-related natural disasters. Between 1991 and 2000, 90% of the 2,557 recorded natural disasters were associated with water. They killed 665,000 people, affected millions of livelihoods around the world, and devastated national economies (UNU, 2013).

Figure 1-1 provides an outline of some of the main pressures on water. Lack of preparedness will exacerbate impacts of

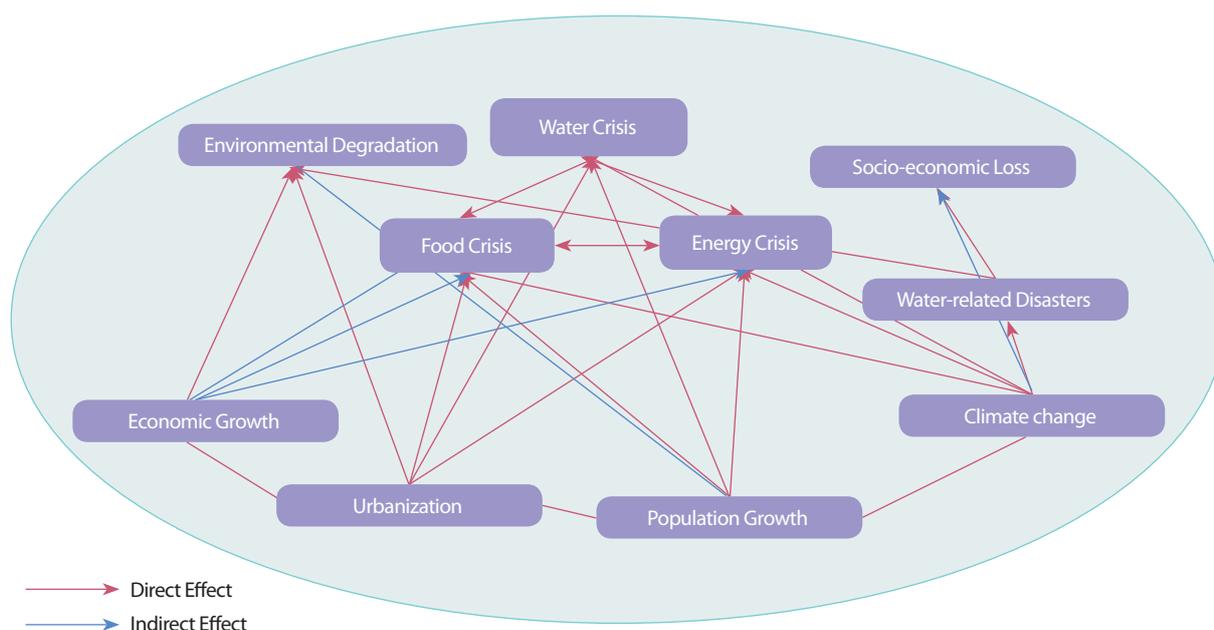


Figure 1-1. Global Challenges and Pressures on Water Resources

water-related challenges as well as imposing threats to global development and degrading the quality of life we endorse and intend to enhance further. The following section introduces these major pressures and possibly how to respond to them. This brings us to a conclusion that a new paradigm of green growth, with water at its center, will provide an all-around solution to tackling not only environmental and water-related challenges but also fulfill development objectives.

Population Growth

In 2014, the world's total population reached 7.2 billion. 1.2 billion live in developed countries, with 6 billion living in developing countries (Population Reference Bureau, 2014). Rapid population growth will lead to an increased demand for land, food, and drinking water, especially in developing countries. The population growth at the global level will put additional pressure on water availability. By 2030, 47% of the world's population is expected to be living under severe water stress. Securing freshwater will be in one of the top priorities for many countries.

Urbanization

Currently, 54% of the world's population live in urban areas, and by 2050, nearly 70% of the world's population is projected to live in urban areas (UN, 2014). This may increase various demands on public utility services, including water and sanitation services, thereby aggravating stress on water and the environment (UN, 2014a; OECD, 2012). Rapid urbanization in many parts of the world will be closely linked with several risks induced by climate change, such as heat stress, extreme precipitation, inland and coastal flooding, landslides, drought, and water scarcity (IPCC, 2014). To reduce associated risks and meet future demands, there is an urgent need to establish resilient water infrastructure and to improve water resources management in cities and informal settlements.

Climate Change

Climate change owing to increases in greenhouse gas (GHG) emissions is an urgent environmental issue, especially for water resources. It directly impacts people and the environment by increasing severity and frequency of water-related disasters, making them less predictable. Most of the natural disasters

are linked to climate change impacts, including floods, coastal sea level rise, storm surges, droughts, heatwaves, forest fires, and land degradation. These phenomena often lead to the loss of lives and resources, unemployment, and creates devastation to the economy. *The OECD Environmental Outlook (2012b)* reported that climate change also threatens people's basic needs, such as access to water, food, and health, while limiting productivity and land and natural resources use. Thus, insufficient attention to climate change can significantly hinder economic growth, induce risks and huge alterations to ecosystems, and affect social well-being.

Environmental Degradation

Water plays a vital role in ecosystem services. Land degradation could reduce global food production in the next 25 years by as much as 12%; that could lead to a 30% increase in world food prices (AfDB, 2012; Pender, 2009). The number of fishermen and fishing boats could decrease owing to coral reef degradation, caused by harmful chemical substances, hazardous waste in water, an increase of water temperature, and over-fishing (UNEP, 2014b). Deforestation and forest degradation could have negative effects on the ecosystem, freshwater resources in the forest, air quality, as well as the livelihoods of the people depending on forest resources (UNEP, 2014b). Water pollution could influence the access to freshwater resources that may trigger food contamination, ecosystem degradation, and various consequences to human health.

Food and Energy Crisis

Water is an essential input to produce food and generate energy. Energy is also required to extract water and distribute food. Agriculture accounts for approximately 70% of total withdrawal, the largest water user across sectors. At the same time, food production accounts for 30% of total energy consumption (UN-Water, 2014). According to FAO (2014), demands for water, food, and energy will be accelerated in coming decades. Food production need to be increased to feed the growing population, thereby leading to increases in water withdrawals. Along with growing demands on food and water, energy will be also consumed significantly to drive socio-economic development.

1.2 Responding to Challenges: A Focal Point of Initiating a New Paradigm

All of these pressures, if not managed properly, may lead to increased water stress as well as additional economic and social costs. Over the past 50 years, water withdrawals have tripled, which has entailed water scarcity and groundwater depletion (World Bank, 2007*b*; 2012). Rapid demographic changes reduced the per capita availability of freshwater and brought about water shortages and water stress. This water stress is compounded by deterioration in water quality due to hazardous waste and saline intrusion into freshwater resources. In addition, climate change, which may increase the frequency of droughts and floods, could have a detrimental impact on the availability of water in the ecosystem. According to the Organization for Economic Cooperation and Development (OECD, 2011), the global water demand is projected to increase by 55% by 2050, escalating of water competition in various regions around the world and potential overexploitation of groundwater resources.

Faced with these challenges, the global community must ask itself whether it intends to continue to exacerbate the situation or to take measures. As the importance of efficient and sustainable management of water is emphasized more than ever, implementing robust policies that will encourage greater sustainability by reinforcing water as a pathway to greener growth is imperative.

Investment in Water Infrastructure

Extensive networks of gray infrastructure have been built over the decades that provide drinking water, wastewater, and storm water services to the public. Dams, weirs, and diversions generate electricity and supply irrigation water to farmers. Many of those infrastructures are now getting old, and are in need of repair or replacement. Therefore, more attention should be paid to investment in green infrastructure to minimize negative environmental impact. Investment in the water sector should sustain, enhance, and rebuild environmental capital, economic assets, and social benefits.

Integrated Water Resources Management (IWRM)

As population grows rapidly and impacts of climate change grow more frequent and severe, water demand is increasing exacerbating available water scarcity. With limited water resources, efficient and equitable water management plan is required. In such regard, concept of the IWRM emerged. Over few decades, the concept of IWRM has been discussed internationally, and the definition of the Global Water Partnership (GWP) is generally being accepted. It is defined as “a process which promotes the co-ordinated 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” (GWP, 2007). Implementing IWRM will bring benefits to river basins such as preventing floods and droughts and protecting ecosystem services, and most importantly, allow establishment of functional institutional arrangements.

Building Resilience to Disasters

The capacity to increase preparedness and resilience to natural disasters, such as floods and droughts, should be reinforced in order to protect livelihoods and socio-economic assets. According to UNESCO (2009), water-related disasters such as floods, windstorms, and droughts account for 90% of total natural disasters globally. In particular, low-income economies are extremely vulnerable to water-related disasters so that preventative measures for enormous socio-economic and environmental losses need to be improved. To reduce risks caused by disasters, integrated approach which economic, environmental, and social sector is considered, should be taken as measures.

Innovation and Technology

Technological innovations can increase water availability through water savings and pollution control. These are considered green growth solutions, as they improve the environment and reduce costs to users with measures to recycle and reuse water, efficient irrigation systems, rainwater catchments, and reclamation of nutrients. With such green growth innovations, energy costs can be reduced and generate savings from reduced fossil fuel consumption, greenhouse gas emissions,

and climate change impacts. The savings can be re-invested in promotion and distribution of green innovation and technology. Other technological tools that contribute to green growth include information and communication technology that will assist water managers to encourage conservation and demand management.

1.3 The Rise of the Green Paradigm: Addressing Development Needs and Environmental Challenges

The industrial revolution of the 19th century brought about mass production, rapid economic development, and widespread environmental pollution. Environmental pollution had been manageable earlier, because it generally occurred on small scales and was easily diluted or assimilated by the nature itself. By the mid-20th century, environmental challenges became more acute, negatively impacting people's livelihoods. The benefits of economic growth were gained at the expense of the environment. The green paradigm indicates that previous approaches to growth, such as the historical behavior of polluting and degrading the environment first and then cleaning up and restoring the environment afterward, must be suspended. Instead, a new path should advocate sustainable development that would protect the environment. It focuses not only on economic development but also on environmental protection and social progress.

Green growth has emerged as a new development paradigm to respond to the traditional unsustainable energy and carbon-intensive models that are based on economic growth without consideration for the environment. Green growth provided a fresh stimulus for society to achieve the dual goals of economic growth and environmental sustainability simultaneously, while benefiting society as a whole. Good practices are found from the development of green technology and the creation of green jobs. This has been supported by political motivation through the adherence of national governments—notably, the Republic of Korea—which have promoted green businesses and green industries and have provided incentives for the business community to join “the green cause”.

While green growth emphasizes the economic and environmental dimensions, the wide range of water-related issues and the cross-cutting nature of water complements green growth, as placing water at the center of development paradigm will include social dimension as well. Not only is water detrimental to meeting economic and environmental objectives, social progress is deemed impossible without access to adequate water and sanitation services. Ensuring such access lies at the very heart of improving quality of life through enhanced health, education, and empowerment of women.

1.4 Green Growth, Then What is Water and Green Growth?

The term, *sustainable development*, was coined by the World Commission on Environment and Development (also known as the Brundtland Commission) in its 1987 report, *Our Common Future*. The report defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. The Brundtland Report also introduced the need for the integration of economic development, natural resources management and protection, and social equity and inclusion, which was central in framing the discussions on sustainable development at the 1992 United Nations Conference on Environment and Development (UNCED) and at subsequent meetings. To achieve sustainable development, economic development, environmental responsibility, and social progress must be balanced (World Bank, 2012).

The concept of Water and Green Growth has stemmed from the global context on how to achieve sustainability and is related to other similar concepts such as *green economy* and *inclusive green growth*. Green economy aims to improve human well-being and social equity while significantly reducing environmental risk and ecological scarcities (UNEP, 2011a). Green growth advocates fostering economic growth and development, while ensuring that natural assets continue to provide environmental services which human beings rely on (OECD, 2011a), which puts more emphasis on economic development and environmental sustainability.

These concepts highlight the need to achieve sustainable development, but somehow do not address all three aspects

of sustainable development equally. The concept of Water and Green Growth was developed to address the balance between the three pillars of sustainable development. Water and Green Growth is a concept that emphasizes the role of water in achieving economic development, the protection and revitalization of ecosystems, and social equity. The three pillars of the sustainable development can benefit from the Water and Green Growth due to the following reasons:

1. **Water is an engine for economic growth.** It expands industrial production, gives more job opportunities, and reduces public expenditure, by mobilizing private sources, NGOs, multilateral and bilateral donors. As water influences the production of goods and services, transportation, and energy production, better water management can enhance economic productivity, energy efficiency, and food security.
2. **Water is a key to maintaining and regulating the balance of ecosystems.** Freshwater improves health of ecosystems and reduces siltation and erosion. It can recharge reservoirs and aquifers, preventing water-related disasters and mitigating climate change impacts. Implementing Water and Green Growth strategy which pursues environmental sustainability with socio-economic development can protect surface and groundwater bodies from the initial stage of development so that environment services can reach higher level of biological diversity and restore natural river functions.
3. **Water is vital to sustaining human life and public health.** Lacking access to clean and safe water may result in water-borne diseases and growth stunting. Water and Green Growth approach can reduce time spent for fetching water, decrease the cost of drinking water and improve quality of life. Moreover, access to water and sanitation is essential for human dignity. Water is a common good and an invaluable asset for human well-being.

To achieve sustainable development, emphasis must be placed on all economic, environmental, and social value of water. Water and Green Growth highlights the role and cross-cutting nature of water in coping with development challenges and reiterates water as an essential element to achieve sustainable development based on the three pillars: economy, environment, and society within policies, programs, and projects. The Water and Green

Growth concept sheds light on the basic needs of developing countries where adequate social welfare and water and sanitation services are not available. It emphasizes the role of water in terms of achieving economic well-being and social equity, coupled with the protection and revitalization of eco-systems.

1.5 An Overview: Water and Green Growth Project

Background: How Korea Came to Initiate the Water and Green Growth Project

Green growth emerged from East Asia in the context of the global economic recession, starting in 2008, after public spending became increasingly restricted. At the time, the Republic of Korea felt the need to pave the way with a new development strategy. The green growth approach became a national agenda for the Republic of Korea, through its drafting of a new law on Green Growth based on its experience in enacting *the Basic Act on Low-Carbon Green Growth*. The Republic of Korea has been pursuing green growth policy since 2008 in an effort to achieve environmentally-sound economic growth using new and renewable technologies. The former president in 2008 initiated the national vision of Low Carbon, Green Growth for the next 60 years. The president defined green growth as “sustainable development reducing greenhouse gas and environmental pollution” and “a new national development paradigm for job creation and new growth by using green and clean technology”.

The Korean government pursued green growth as a new vision of the country to respond to climate change, to promote renewable energy supplies, to create new growth engines, and to enhance the well-being of people. Enriched by its experience as the only country to have transformed from overseas development aid recipient to donor in the space of some 50-odd years, Korea is desirous to illustrate the model development example to other developing countries. Because Korea’s experience of rapid economic growth resulted in consequent environmental damages, it aims to incorporate “green strategies” into its overall economic development plan, shifting its focus from quantitative growth to qualitative development and reducing dependency on fossil fuels.

In 2009, the Korean government formulated a *Five-Year-Action Plan for Green Growth*, and in 2010, established the Global Green Growth Institute to share its experience of green growth policies and promote knowledge exchange throughout the world. Korea's green growth policy is different from global initiatives for climate change adaptation led by developed countries. The policy focuses not only on fostering eco-efficiency and economic growth in Korea, but on elevating green growth to a global agenda contributing to worldwide progress.

Korea's *Five-Year Action Plan for Green Growth* places a focus on economic growth and environmental protection. Since the 1960s, the Korean government embraced two main development strategies *Five-Year Economic Plans* and *The Ten-Year National Territorial Development Plan*. The government integrated economic growth and territorial policies and implemented the policy in conjunction with territorial development strategies. At the same time, *the National Water Resources Plan* was used to oversee water resources use, development, and protection in Korea. The policies for water resources management had evolved from 1965 to 2010 with different development objectives:



The government strived to achieve stable distribution of agricultural water and development reservoirs in the 1970s and 1980s. As time went on, the policy direction has changed into more comprehensive development plans, aimed at coping with natural disasters and providing stable living conditions for the public.

The current water management plan is the *Water Resources Long-Term Plan (2001-2020)* that was established for sound water use and protection of water environments. Water resources management in Korea had been a key factor in economic development, and significantly contributed to "the miracle of the Han River", which symbolizes Korea's rapid economic development from 1961 to 1996. Korea has achieved rapid

economic development based on the export-driven strategy and heavy and chemical industries. It should be understood that such growth strategy was largely supported by its efforts to supply and allocate water resources to industrial and domestic use, as well as its well-planned water and sanitation services.

Water resources management can be a key role in enabling green growth to work toward sustainable development. To achieve economic growth, ensure environmental sustainability and improve social development simultaneously, there is a need to put emphasis on water resources management, build resilient water infrastructure and strengthen the capacity of local and national governments to implement appropriate policies. The Korean government felt that a joint project with the World Water Council would be useful in demonstrating to developing countries various water-related policy options to achieve green growth while resolving global water challenges sustainably. As Korea had experienced rapid economic growth in a short time period, the country could provide a wide range of knowledge in using water management as a means to environmentally and socially sound economic prosperity.

The project aims to recommend the concept of Water and Green Growth and explore the roles and significance of water towards the achievement of green growth. In addition, this report proposes a policy guideline that can serve as a tool to implement related policies, plans, and programs, based on the evaluation of good practices through an initial analysis of 26 case studies in 2011 and a more in-depth analysis of 11 case studies in 2014. The project aimed to develop the analytical framework on assessing institutions and performances of Water and Green Growth and to recommend a general policy guideline and policy options that includes policy directions to support the implementation of Water and Green Growth.

Timeline of Water and Green Growth Project

The Water and Green Growth Project began in 2010 and was conducted in three phases towards 2015. The final outcomes and its reports were presented at the 7th World Water Forum in Daegu-Gyeongbuk in April 2015.



Figure 1-2. Progress of the Water and Green Growth Project

Phase 1 (2010 ~ 2012)

The Water and Green Growth (WGG) Project was initiated in November 2010 when the Phase 1 Memorandum of Understanding (MoU) was signed between the Ministry of Land, Transport and Maritime Affairs of Korea [MLTM, currently the Ministry of Land, Infrastructure and Transport (MOLIT)] and the World Water Council, with the objective of drawing attention to

a new development paradigm involving water while resolving water challenges. The concept of Water and Green Growth was developed notably during discussions at a WGG Expert Meeting on World Water Day (March, 2011) in the Republic of South Africa. The concept of Water and Green Growth, or green growth with a focus on water use, was defined as a strategy that could be used as an applicable policy approach for sustainable development.



1. Phase 1 MoU Signing Ceremony (Korea-WWC)
 (Nov. 29, 2010, Seoul, Korea)



2. WGG Expert Meeting
 (Mar. 20, 2011, Cape Town, South Africa)



3. Launching the 1st Edition WGG Report
 The 6th World Water Forum
 (Mar. 13, 2012, Marseille, France)



4. Korea Was Designated as a Host of the 7th WWF
 The 6th World Water Forum
 (Mar. 16, 2012, Marseille, France)

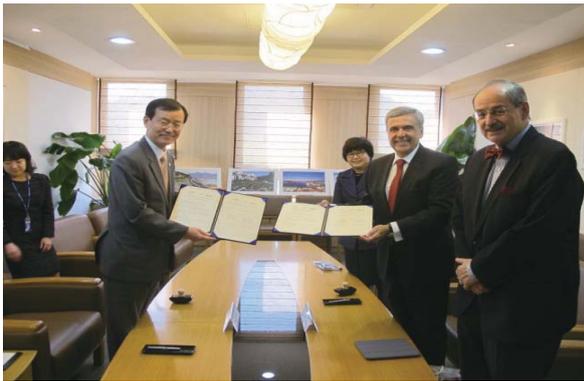
The Phase 1 report, officially launched during the 6th World Water Forum on March 2012 in Marseille, consolidated the concept of WGG. It suggested basic WGG principles to policy makers based on an analysis of 26 global case studies. During this same period, Korea was announced as the host country for the 7th World Water Forum.

Phase 2 (2012 ~ 2013)

Phase 2 of the WGG Project began in October 2012, with the signing of the Phase 2 MoU between MLTM (now MOLIT) and the World Water Council (WWC). At this stage, the concept of WGG was further developed and reinforced through in-depth case studies, with the Lake Sihwa Water Quality Improvement Project as the pilot case study. Then, the institutional aspects of exogenous and endogenous factors, water institutions and performance were analyzed, for both developed and developing countries. Research

outcomes and analytical approaches were introduced to the international community in 2013 at various international water-related events, such as the World Water Week in Stockholm and the Budapest Water Summit. In order to establish a peer-review process to improve the research outcomes, the WGG High Level Panel (HLP) composed of international water experts was established. An Expert Workshop organized in September 2013 provided the opportunity to reflect the opinions of international water experts in the research.

In May 2013, Water and Green Growth was selected as one of the main agenda of the 7th World Water Forum, since it was voted as the 5th most important thematic issue to be addressed at the Forum according to the survey results conducted at the 7th Forum Kick-off Meeting. Subsequently, WGG became one of the 16 themes in 7th Forum's Thematic Procession: Session 3.1 Green Growth, Water Stewardship, and Industry.



5. Phase 2 MoU Signing Ceremony (Korea-WWC)
(Oct.15, 2012, Seoul, Korea)



6. WGG Was Voted as the 5th Most Important Agenda for the 7th World Water Forum
The 7th Forum Kick-Off Meeting
(May 14-15, 2013, Daegu, Korea)



7. WGG Side Event at World Water Week 2013
(Sep. 1-6, 2013, Stockholm, Sweden)



8. Presenting the WGG Project to WWC Member Organizations.
Budapest Water Summit
(Oct. 8-10, 2013, Budapest, Hungary)

Phase 3 (2014 ~ 2015)

The Phase 3 WGG research began in February 2014 with the signing of the Phase 3 MoU among the Korean National Committee for the 7th World Water Forum Korea (WWFKNC or NC), K-water and the World Water Council in Gyeongju, Korea during the 2nd Stakeholders Consultation Meeting (SCM) for the 7th World Water Forum. In the SCM, the WGG Team decided to participate in the 7th Forum's Asia-Pacific Regional Process as well. In the Asia-Pacific Governing Council Meeting in Singapore International Water Week, which was held in June 2014, Water and Green Growth has been set as a session theme under the Asia-Pacific Regional Process.

Continuing from Phase 2, Phase 3 made great efforts to conduct more in-depth case studies to investigate greater details of the WGG concept in practice. A total of 11 case studies were finalized, and the final outcomes were shared during water-related international events in 2014, such as at the Istanbul International Water Forum, the Singapore International Water Week, and the World Water Week in Stockholm. After analyzing the outcomes of the case studies, this final report presents the policy guideline (which has been developed from the Phase 1 "policy framework"¹⁾, the policy mix, and the policy implementation roadmap. The report was launched at the 7th World Water Forum in Korea in April 2015.



9. Phase 3 MoU Signing Ceremony (Korea-WWC)
(Feb.27, 2014, Gyeongju, Korea)



10. Disseminated WGG Research Outcomes at Various International Events (From right: Istanbul International Water Forum, 27-29 May; Singapore International Water Week, 1-5 June; Stockholm World Water Week, 31 Aug-5 Sep)

1) The term "policy framework" was revised as policy guideline, as it can create confusion with the term, analytical framework in the report.

1.6 Summary of the Water and Green Growth Research

Analytical Framework and Methodology

The WGG Team has employed three approaches to developing the concrete policy guideline: the strategic approach, the institutional approach, and the evidence-based approach. The strategic approaches in the “policy framework” were based on the three pillars of sustainable development: economic, environmental, and social dimensions. This approach was used to analyze a series of case studies and to evaluate successful water-related institutions and policy instruments. The institutional approach expanded the analysis to include the relationships and interactions among the exogenous and endogenous factors, relevant institutions, and the performance of projects and programs. The policy mix is also discussed in relation to the state-driven, market-oriented, and community-centered levels of water management to identify effective combination types of institutional tracks. The evidence-based approach has been used to analyze a series of case studies and to develop policy implications from them. The WGG Project has focused on 11 selected cases from 10 countries worldwide in order to assess the instrumental role of water for economic development, environmental protection, and social progress.

To assess the relationships among exogenous and endogenous factors, institutions and policy and performance, both qualitative and quantitative analyses have been undertaken. Diverse in-depth case studies of WGG-related projects were analyzed to gain better understanding of the project’s exogenous factors and discuss the extent to which policies and related institutions (state-driven, market-oriented, community-centered) interact to contribute to project performance. In addition, the project aims to compare the socio-political and economic conditions before and after the projects that are included in the case studies with special reference to the economic, environmental, and social performance perspectives. Since there is no “one-size-fits-all” prescription for implementing a green growth strategy related to water, national development strategies must be devised and implemented in consideration of each country’s contexts, strengths, and constraints. Developed, emerging, and developing countries face different challenges and opportunities,

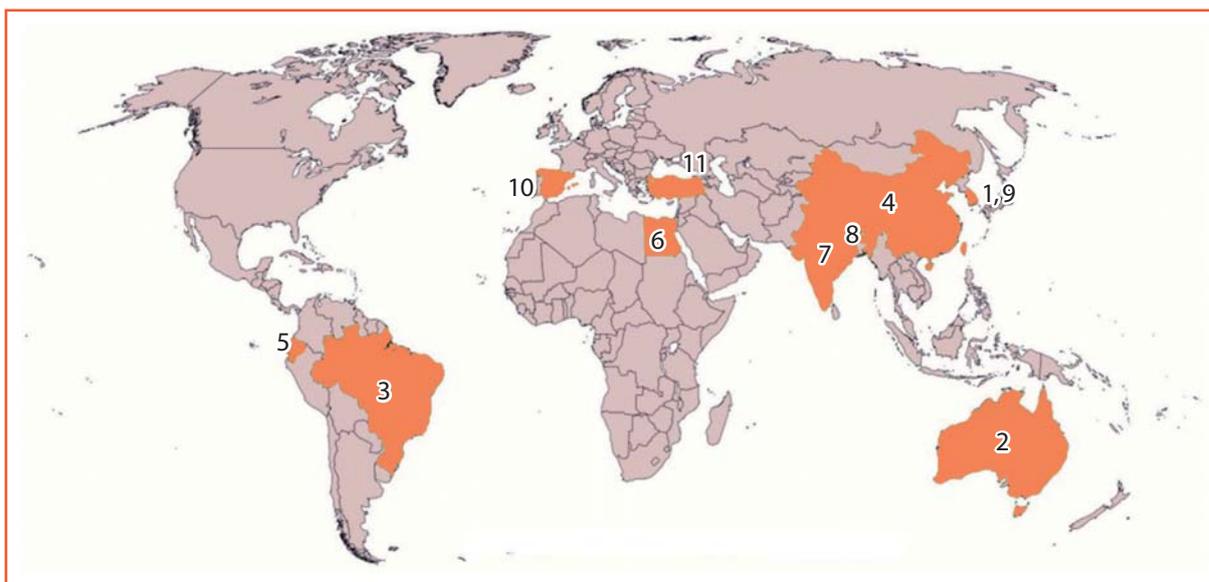
as do countries with diverse socio-economic and political circumstances (OECD, 2012a). The research has identified an array of policy options from the case studies in order to present policy suggestions for Water and Green Growth.

Case Studies

Eleven international case studies were selected by the Steering Committee in order to narrow down the earlier work on 26 case studies, to explore the role of water in green growth and to enhance effectiveness green growth policies. They were chosen to investigate the economic, social, political, environmental, and technological contexts in which water projects took place; the policies and institutions that mark the project’s course from its planning stage at the beginning to the present; and the changes in those policies and institutions over time. Exogenous and endogenous factors along with existing institutions are discussed together to analyze the performances of WGG case studies, with the objective to derive policy implications. More in-depth research for case studies provided empirical evidence to support the new policy guideline.

Although each case is complex in nature and demonstrates diverse contextual and institutional aspects, all of them generally conform to criteria related to the role of water within economic growth, environmental protection and social development. The evaluations were conducted through a survey of experts and stakeholders with knowledge of the WGG Project who assessed the performance levels across each of these three dimensions.

As listed in Box 1-1, the 11 selected case studies were drawn from a diverse range of locations. The case studies were chosen to illustrate the contribution of water to green growth from an institutional perspective. Moreover, the cases unveil how important the green growth concept is in efficient and effective management of water resources. In each case study, the major findings and policy implications have been identified, and an appropriate policy mix suggested, depending on the context of each region and state as well as the phase of development. Quantitative and qualitative analyses have been undertaken in order to evaluate the level of WGG for measurement of performance.



Box 1-1. Water and Green Growth Case Studies

1. **Republic of Korea** Lake Sihwa Water Quality Improvement Project
2. **Australia** Murray Darling River Basin: Water Trading and Water Use Efficiency
3. **Brazil** Integrated Water Resources Management: How National Policy and Practices Support Green Growth
4. **China** Shanghai Pudong: Public-Private Partnership
5. **Ecuador** Water Fund Mechanisms for Watershed Protection
6. **Egypt** Desalination for Agricultural Development
7. **India** Water Management in Gujarat State: Mix of Policy and Infrastructure Initiatives Result in Green Growth
8. **Nepal** The Andhikhola Hydrel and Rural Electrification Project
9. **Republic of Korea** Taehwa River Ecological Restoration Project
10. **Spain** Ebro River Basin: Sound Water Planning Supports Green Growth
11. **Turkey** Restoration of an Urban Estuary: Golden Horn, Istanbul

Chapter 2 below sketches the global trends on Water and Green Growth and introduces the three-part analytical framework including a strategic approach, an institutional approach, and an evidence-based approach. In Chapter 3, through analyses of the 11 in-depth case studies, major findings and directions for policy implementation are provided. Based on the analyses in Chapter 3, Chapter 4 updates and further develops the policy guideline developed from the Phase 1 policy framework, and provides detailed policy directions. The policy mix is identified as a mixture of state-driven, market-oriented, or community-centered institutional tracks. The outcome leads to a roadmap emphasizing one of the three policy implementation directions, with complementary attention given to the other two.

Chapter 5 provides a summary of the discussion, including a list of key messages and primary actions recommended on how to achieve WGG, as well as the next steps.



CHAPTER 2

WATER AND GREEN GROWTH

This chapter sheds light on global trends regarding Water and Green Growth. The concept of Water and Green Growth can provide real opportunities to solve water-related challenges and can foster inclusive economic growth ensuring environmental and social sustainability, which are the three pillars of sustainable development. Common perceptions of international organizations on the green paradigm will be outlined to emphasize the role of water in green growth. In this regard, the Water and Green Growth Project has conducted case studies to develop a policy implementation roadmap for developing and developed countries. The analytical framework will be introduced in this chapter.

2.1 Setting the Background: Sustainable Development and Green Growth

The goal of every country is to develop: the more development, the better. Even developed countries continue to strive for development. Such is the will of citizens who wish to enjoy higher standards of living and is the mandate of governments that wish to remain in power by increasing absolute welfare of their citizens. However, this “strive for development” has come at a cost. Mass production and increasing levels of consumption over time has led to environmental degradation from over-extraction of natural resources and the excessive releases of domestic and industrial waste. Thus, it became clear that the environment and the boundaries of what environment can process and absorb without undergoing irreversible change, the so-called “planetary boundaries”²⁾, must be respected in pursuing development. In other words, development must be environmentally sustainable.

The concept of green growth has arisen in line with this goal of sustainable development that economic growth must be pursued in a manner that does not harm the environment and may even promote its recovery and resilience. Such greening of the economy is an essential part of moving towards sustainable development. It should be noted that sustainable development is an earlier concept than *green growth* and *green economy*. In addition, it is a more holistic concept than green growth and green economy. This is because it explicitly emphasizes three dimensions: economic, environmental, and social (also known as the three pillars of sustainable development), instead of just economic and environmental dimensions. In regard, the holistic concept of sustainable development would seem to obviate the need for the newer concepts of green growth and green economy. However, this simply is not the case.

The broad scope of the concept of sustainable development has made it difficult to translate it into specific actions. While much has been discussed about the importance of sustainable development by governments, intergovernmental organizations (IGOs), non-governmental organizations (NGOs), academics, and sometimes even business leaders, it is difficult to find any cases

of unambiguous sustainable development in practice. Rather, much emphasis was given on “environmental sustainability”, promoted mostly by environmental activists and civil societies in developed countries. Such approach de-emphasizes the development aspect, providing very weak logic for international society, especially for governments of developing countries, to move away from resource-intensive and growth-centric economic model. Businesses still have much to gain from their environmentally unconcerned business as usual. Also, it rarely provides incentives for consumers to discard their consumption patterns. Old habits die hard, especially when the concept of sustainable development have rarely convinced these actors.

On the other hand, green growth and green economy have provided fresh impetus for societies to attempt at achieving twin goals of economic growth and environmental sustainability. They have done so conceptually by stressing not only that growth must not harm the environment but also that economic growth and environmental sustainability can be complementary, for example, through the development of green technology and green jobs and through utilizing environment and ecology as cultural and recreational space. Along with this conceptual comprehensibility, political sponsorship by national governments-notably the Republic of Korea, as well as others-which have promoted green industry and green business practices, have created incentives for the business community to join the cause of sustainability. All this is in addition to the support of green growth (and green economy) by international organizations including the Organisation for Economic Cooperation and Development (OECD), United Nations Environmental Programme (UNEP) and the World Bank; regional organizations such as The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and the African Development Bank (AfDB); and international NGOs such as IUCN and the WWF. The net effect of the green growth concept has increased operationalization of sustainability and drew in more actors to the cause, most notably governments and industry. While it was difficult to bring about actual sustainable development from the concept of sustainable development, the concept of green growth has brought society closer to that goal.

2) Rockström et al. (2009)

2.2. The Green Paradigm

With regard to the definitions of green growth, it is worth reviewing similar approaches that have stemmed from sustainable development. The first concept that conveys a similar meaning is *eco-efficiency*, which was first introduced by the World Business Council for Sustainable Development in 1992. Eco-efficiency aims for ecological and economic efficiency, referring to a new business concept that minimizes use of energy, materials, and other resources per unit of production (WBCSD, 2000). The approach combines the concepts of environmental accountability with high profitability (WBCSD, 2000). In the past, concepts related to green growth failed to comprise comprehensive development strategies in regards to all three pillars of sustainable development. Social development has received less attention in the implementation of green growth policies. When the issue of social dimension within the *green economy* was discussed at the 2012 Rio+ 20 Summit, it became clear that the achievement of economic growth and environmental protection cannot automatically guarantee a good quality of life. For example, policies that encourage shifting to a low-carbon and resource-saving lifestyle may generate massive economic burdens on low-income households. Accordingly, it should be understood that the pursuit of any green growth policy must be accompanied by a series of relevant programs on equitable social development to enhance the quality of life.

Introduced by UNEP through its Green Economy Initiative in 2008, *green economy* is an economy “that results in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities” (UNEP, 2010). The OECD (2011a, p.9, 18, 114) characterizes green growth as “fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies”. The term *inclusive green growth* was coined by the World Bank (2012) as it cannot be presumed that the concept of green growth is “inclusive”. It can be defined as “growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, [...] resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters,” and inclusive in that it

has poverty alleviation as one of its goals (World Bank, 2012, p.2). The World Bank (2012) argues that green growth policies must be carefully designed in consideration of “maximizing benefits for and minimizing costs to the poor and most vulnerable”. These terms began to shed new light on social dimension more than before and also recognizes water as one of the most fundamental elements to have a profound impact on the achievement of green growth (UNEP, 2011; 2012; World Bank, 2012). Even though a wide range of international organizations have used slightly different concepts, their underlying arguments are closely aligned: our traditional growth paradigm must transition into a more sustainable way.

2.3 Why Water and Green Growth?

So then why water and green growth? Why not just sustainable development, or just green growth that is done in a way that addresses social dimension? The answer is that it is relevant by seeking to address the three pillars of sustainable development that other concepts seek to address while differentiating itself from them in terms of its scope and focus and in terms of its proximity to actionable solutions. Attention to water can play a complementary role to green growth in moving toward sustainable development. Water effectively draws attention to and plays a part in reiterating the social dimension. Although green growth approach make efforts to be “inclusive”, the approach itself does not extend adequately into social dimensions to enable sustainable development to be achieved. The addition of water resources management plays a key role in enabling green growth to work more specifically toward social development goals. It can be argued that highlighting the role of water in green growth is very important in achieving not only economic and environmental dimensions of sustainable development, but in achieving social goals, especially at strategic and operational levels. While focusing on water is not the only way to address social development needs, each aspect of social development can be illustrated in relation to water issues.

First, water is a basic necessity for survival and of human well-being. Access to water supply and sanitation services is an essential part of meeting basic needs and ensuring a certain level of quality of life. Second, water has great cultural and recreational

value. Developing waterfront areas for recreational purposes can contribute to higher quality of life. Pristine and vibrant aquatic environments, as well as man-made pools, fountains, and other water structures, have great aesthetic, intrinsic, and salutary values to those who reside near them. Third, water pricing may have positive implications for increasing equality of access to water provision and the quality of water services. Fourth, resilient water infrastructure mitigates the social and economic costs of natural disasters such as floods and droughts. People are less likely to perish, be displaced, suffer from insecurity arising from economic and social loss, and be sick from contaminated floodwaters. Fifth, water scarcity can be a source of conflict. In regard, good water management will minimize its scarcity and reduce the potential for conflict around such resources. Sixth, water governance arrangements especially at local level (e.g. water user associations, or WUAs) have significant implications for social empowerment and participation in the political process. This can lead to a better sense of place and fairness within the society, especially for women. Eighth, treating wastewater and maintaining the quality of environmental water prevents water bodies from reeking and being unpleasant, lowering the quality of life for residents around them. Ninth, the lack of access to piped water and indoor sanitation has perpetuated great disadvantages to women in terms of gender inequality, lost opportunities, and vulnerability. Providing these services will reduce these gender disadvantages. Therefore, in terms of health and basic needs, equity and gender equality, ownership and empowerment, and quality of life and connection with the natural environment, there is tremendous room for the social aspect of sustainable development to be improved through effective management of water resources and services compared to it being covered by green growth alone.

In addition to water's significant role in social development, water contributes fundamentally to economic growth and environmental sustainability. From an environmental aspect, water is the cornerstone of both aquatic and terrestrial ecosystems, and therefore of biodiversity and biological life, including human life. Water is necessary for drinking, for producing food, and for maintaining various environmental functions of natural, social, and economic values. From an economic perspective, water is a natural resource and a factor of

production. For example, this is obvious in irrigation plans when an increased water supply needs to be calculated but less obvious in other cases, such as in plans to build nuclear power plants disregard the water available for cooling as a scarce resource. Water also has economic characteristics and its availability and degree of development can serve as an upper boundary to economic development. Without water, production is impossible. Without production, economic development is impossible. Without economic development, recognizing the interdependency of the three pillars of sustainable development and realizing social development is practically impossible. Moreover, neither economic nor social development can be sustained in the long run without a healthy environmental base.

As green growth provides enhanced conceptual comprehensibility and operational tangibility to achieve sustainable development, Water and Green Growth will do the same in achieving green growth towards sustainable development. Figure 2-1 shows how the three dimensions-economy, environment, and society-interact to attain sustainable development. As mentioned above, water not only impacts the economy and the environment, crucial areas for green growth, but is a basic human need, essential for production, sanitation services and public health. This new strategy will highlight the role of water resources in agriculture, industries, households, and the environment and its contribution to continuous social and political development. In regard, Water and Green Growth has been defined as a "the concept that emphasizes the role of water in achieving economic well-being and social equity coupled with the protection and revitalization of ecosystems". This definition stresses the importance of two parts: 1) water's role and 2) economic, environmental, and social well-being-in other words, sustainable development. These two emphases are justified on the grounds of water's cross-cutting role and fundamental place within the three pillars of sustainable development.

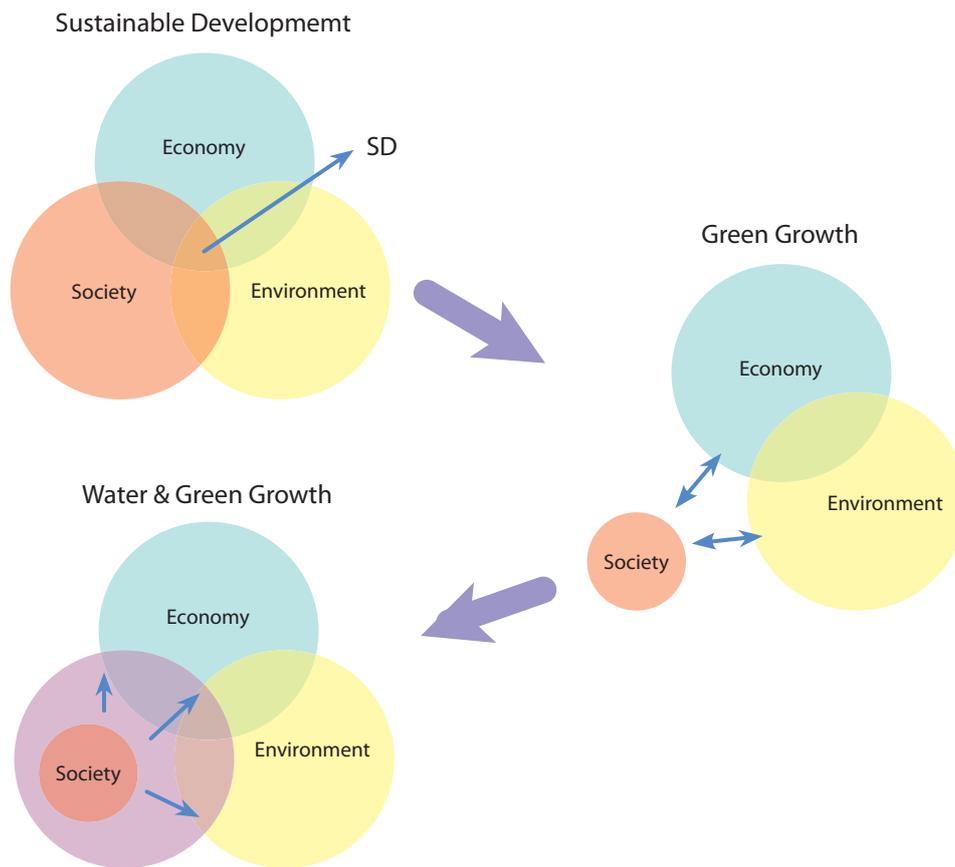


Figure 2-1. How Water Enables Green Growth to Reach Sustainable Development

2.4 The Three Approaches of the WGG Project

The Strategic Approach: Conceptualization

Now that there is better understanding of the rationale behind the development of Water and Green Growth concept, this section will illustrate the strategic approach of the WGG Project that composed of conceptualizing Water and Green Growth and formulating strategies under the concept. As mentioned in the previous section, Water and Green Growth is “the concept that emphasizes the role of water in achieving economic well-being and social equity coupled with the protection and revitalization of ecosystems”. This concept was developed from the definition of Water and Green Growth in Phase 1: “a strategy to invest in water infrastructure and water security that fosters economic growth and development, protects the environment and the services it provides, and enhances social inclusive development”, out of belief that it is too narrow and fails to cover all water-related issues by focusing on investment in infrastructure.

The goal of conceptualizing Water and Green Growth was to clarify the extent to which water issues should be positioned within the framework of green growth and to develop interlinked strategic options between green growth and Water and Green Growth. In particular, there are three objectives of conceptualizing Water and Green Growth. The primary purpose of the conceptualization of Water and Green Growth is to dismantle the way complex issues have been tackled within the framework of the conventional approach to socio-economic development. This is directly associated with the historical behavior of polluting and degrading the environment first and then cleaning up and restoring the environment afterward. While many developing countries are warned against such an approach, sometimes they have no other option other than to adopt it. Even though developed countries have argued that developing countries must accept a constellation of strict rules and regulations on environmental protection, many developing countries are unable to reach a higher level of socio-economic development, without impacting the environment, based on the current construct of the world

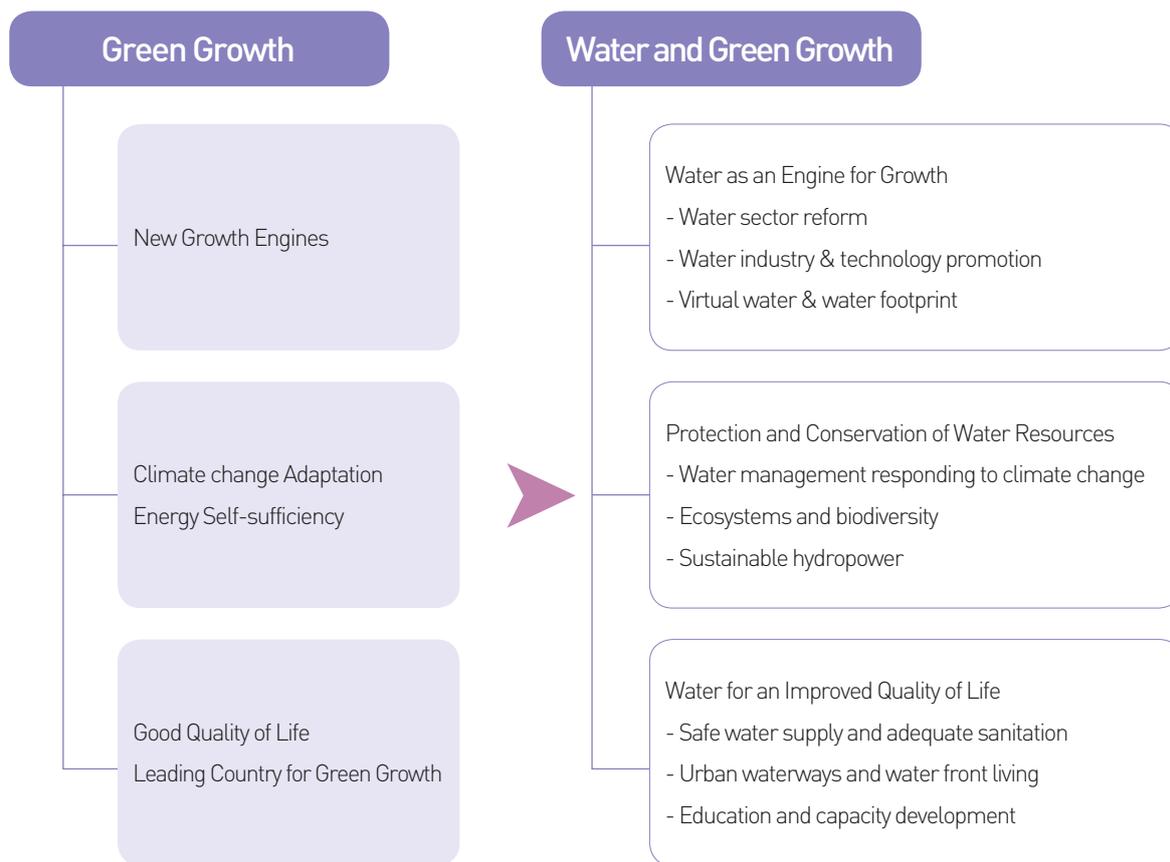


Figure 2-2. Water and Green Growth – A Strategic Approach

political-economic system.

The second purpose is to highlight the past, on-going, and future contribution of the water sector in achievement of green growth not only in developed but also in developing countries. Whenever development issues are discussed, economic indicators and results are often referred to and utilized to evaluate the degree of economic performance in a country, such as gross domestic product (GDP). While identifying ways to promote economic growth in a country, however, there are hidden variables that should have been considered, including the contribution of the water sector. Even though water has been one of the primary inputs to manufacturing any commodity, the significance of water in society has been ignored and marginalized. This study can remind the public of the profound contribution of water to the overall development of society and economy and eradication of poverty.

Third, the Water and Green Growth approach sheds light on the matter of basic needs of people in developing countries,

which is often de-emphasized in countries that are committed to achievement of the quickest economic growth in the shortest period of time. In many countries in Africa and Southeast Asia, for instance, the policy emphasis on economic growth has left the provision of basic social services unfulfilled. Therefore, large numbers of poor families and vulnerable groups, including children, women, the elderly and indigenous populations, suffer due to a lack of basic services, including piped water supply and sanitation service networks. This phenomenon has a negative effect on society as a whole, and often ends up widening the income and living standard gap between the rich and the poor. Also, children often contract diarrhoea and other water-borne diseases that make them unable to attend school. This vicious cycle could be terminated with systematic and aggressive policies that would better equip them to tackle the complex issues related to social development. For example, access to safe drinking water and sanitation can improve gender equality and women's empowerment. Access to water reduces the burden of fetching water, allowing women and girls more time for productive activities. Access to improved sanitation enhances

dignity and safety and enables girls to stay in school beyond puberty. Moreover, it has been found that involving women in water management improves project outcomes and encourages women to take on leadership positions.

On top of these objectives, it should be understood that Water and Green Growth is not only a concept but also a practical strategy. In 2009, the Korean government has specified a list of strategic ideas on how to achieve green growth by 2050 with detailed targets. Such detailed targets reflect thorough and exhaustive studies and research results based on ideas and thoughts from experts in various fields in Korea society. The approach also touches on the country's strategies for survival and prosperity with the goal of achieving an environmentally sound society. Finally, it responds to the demands from the international community on how to address increasing risks due to climate change and energy security.

By analogy, a series of interlinked strategic option follows on the inclusion of water with green growth in development programs, as illustrated in Figure 2-2. To note, this strategic approach has been developed in Phase 1 of the WGG Project. The three main options are:

- (1) Water as an Engine for Growth;
- (2) Protection and Conservation of Water Resources; and
- (3) Water for an Improved Quality of Life.

With new growth engines in Water and Green Growth, conventional approach regarding the value of environment for society should be reappraised. The environment itself should be adequately protected and preserved but should also be developed and utilized in a sustainable manner for the benefit of society. Numerous attempts have been made to achieve a sound interface between human beings and the environment, particularly in the water sector. One of the basic approaches has been to secure safe water supply and adequate sanitation using appropriate funding as well as suitable government policies. The present study prioritizes the value of institutional reform for the water sector as a prerequisite to investment in new water infrastructure. A lack of careful appraisal of institutional issues could turn such investments as multipurpose dams, piped-water supply systems and long-distance aqueducts into political, economic, social and/or environmental disasters. New approaches to development

planning can be an opportunity for remedying such long-term problems in the water services sector as inefficiency management, lack of investment and low levels of water service quality. The use of external expertise, private funding, and operational knowledge can stimulate the development of technology and service infrastructure as well as create new jobs.

With implementation of climate change and energy programs, governments should commit to developing appropriate water management and water resources development strategies that incorporate policies and programs to develop sustainable hydropower, and introducing ecological and economic efficiency. The policies on sustainable hydropower development involve minimizing environmental impacts while maximizing socio-economic benefits, such as concentrating on small- and medium-sized hydropower dams where appropriate instead of large-scale, multipurpose dams

New policies initiated under Water and Green Growth strongly influence the quality of life for the general public. Programs will be implemented to protect and revitalize ecosystems and biodiversity in various water bodies, including urban streams and rivers. Living conditions in urban areas should improve with the rehabilitation of urban water systems that have deteriorated or become severely polluted through rapid urbanization, population growth, and industrialization. "Waterfront living" can be realized in urban areas where water environments are protected, and urban living can recapture the lost vision of a natural habitat.

The vital significance of water to economic growth, environmental protection and social development has been connected to the nexus between water and other areas, such as food, energy, and climate change. This reinforces the pivotal role of water management in achieving sensible strategies on how to cope with growing water demand, reduction of water availability, deterioration of water quality, and acute water-related disasters. Water and Green Growth provides a new impetus on how to tackle such challenges with special reference to the economic, environmental and social dimensions, following the primary scope of sustainable development. Water and Green Growth strategies embrace concrete policies and programs for identifying water as an engine for growth, for the protection and conservation of water resources, and for leveraging water for an improved quality of life. In order to support implementation of this theoretical construct, it

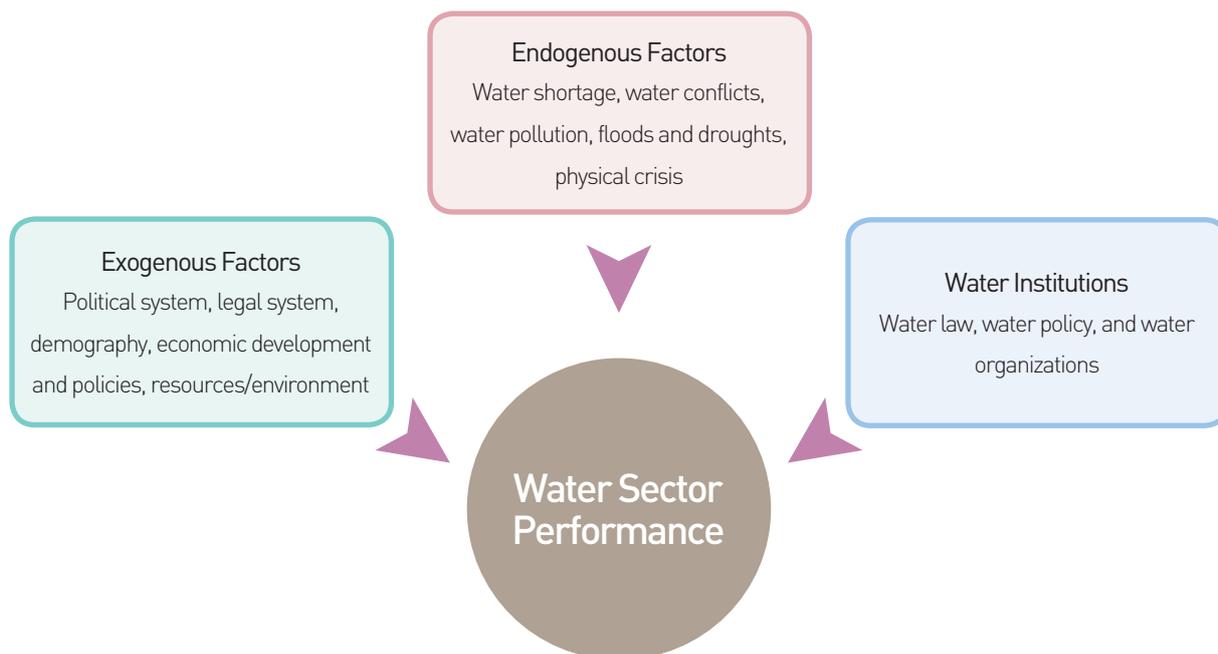


Figure 2-3. The IDA Framework (Source: Saleth and Dinar. 2004. *The Institutional Economics of Water*)

is necessary to pass from the conceptual underpinning towards more concrete measures. Practical solutions and programs must, thus, be identified within an appropriate policy framework. In order to explore the feasibility of and develop this policy framework with entailing policy directions developed in Phase 1, institutional and evidence-based approaches were adopted in Phases 2 and 3.

The Institutional Approach: Phases 2 and 3

Water and Green Growth is conceptualized based on the assumption of the significant contribution of water for economic growth, environmental protection and social development. The concept maintains that water cannot be considered only as one element within the ecosystem to be protected and utilized, but also as a primary instrument for sustainable socio-economic development in a given country. In addition, it is fundamental to any development agenda. However, the conceptualization does not necessarily provide a clear direction to policy makers on how to “utilize” water as a vector for achieving a broader green growth agenda, in connection with sustainable water resources management.

This research deploys a complementary analytical framework in order to assess the extent to which past projects, which have already accommodated the basic principles of Water and Green

Growth, have been devised and implemented in the course of institutional changes. The analytical framework is adopted from the work of Saleth and Dinar (2004; 2005) which employs the Institutional Decomposition and Analysis (IDA) framework. The IDA framework anatomizes water institutions, which consist of water law, water policy, and water administration and evaluates the extent to which water institutions have evolved and changed in interaction with endogenous and exogenous factors. This framework serves as a platform to comprehend the way diverse Water and Green Growth projects have been planned and implemented.

In addition to the IDA framework, the study reinforces the analytical framework by paying special attention to which socio-economic and political aspects impact the institutional changes for Water and Green Growth. Conventionally, the water sector has been dominated by the state, as a strong advocate for water as a public good, which left little room for other social actors in decision-making and implementation. Figure 2-3 illustrates the IDA framework developed by Saleth and Dinar (2004).

Over the last few decades, non-government actors have increasingly contributed to the water sector as a whole in the forms of private sector participation and the emergence of civil society. It is not uncommon to witness an “outsourcing” of water-related policies, programs, and services to non-state actors, not

only in developed but also in developing countries. Therefore, water-related laws, policies, and organizations have co-evolved in line with such trends, necessitating particular policy approaches. Such approaches are largely categorized as state-driven, market-oriented, or community-centered institutions. This demonstrates a gradual shift in the architecture for water policy-making and implementation, including non-state actors, such as private companies, and civil society groups.

Water institutions for Water and Green Growth have co-evolved in accordance with exogenous and endogenous factors. Water and Green Growth-related laws, water policies, and water organizations (Water and Green Growth institutions) are often revised, amended, and reshaped depending on various purposes – economic, social, and environmental. Therefore, it is vital to note that state-driven, market-oriented or community-centered policy approaches have a profound impact on institutional changes in water institutions, which are often affected by exogenous (political system, legal system, demography, economic development and policies, and environment/resources) and endogenous (water scarcity, water conflicts, financial and physical crisis) factors (Saleth and Dinar, 2005).

The three institutional approaches encompass a number of useful instruments. For example, the state-driven institutions encompass water laws and regulations, well-organized hierarchical plans at the national, regional, local and project levels, fiscal policy such as subsidy and tax, and technology promotion policy. In contrast, cost recovery principles for water pricing, water rights trading and policies to promote private

sector participation in the water sector exemplify a market-oriented institution. With regard to the community-centered policy approach, stakeholder participation in decision making and implementation for water projects can be institutionalized. Also, the level of stakeholder participation should be as extensive as possible so that local residents gain better access to information on decision-making processes. Conflict resolution mechanisms must also be seriously considered in the mainstream policy agenda at the local and central levels.

On the basis of the analytical framework discussed above, this study appraises the performance of each case according to the three major pillars of Water and Green Growth – economy, environment and society. The policy framework for Water and Green Growth has introduced these three primary focuses for the achievement of Water and Green Growth as: 1) Water as an Engine for Growth (economy); 2) Protection and Conservation of Water Resources (the environment/water); and 3) Water for an Improved Quality of Life (society);

The overall assessment of these three areas is intended to delineate the degree to which each project has achieved the goals for Water and Green Growth. The economic performance of each project is measured by a set of indicators – GDP, job creation rate, extent of the balanced growth and price stability, and FDI net flow. Environmental performance is measured by improvement of water quality, freshwater availability, biodiversity, safety from disaster, and reforestation. To measure the degree of social performance, five indicators were employed, including the enhancement of public health, improvement of quality of life, equity between social groups and gender, and degree of

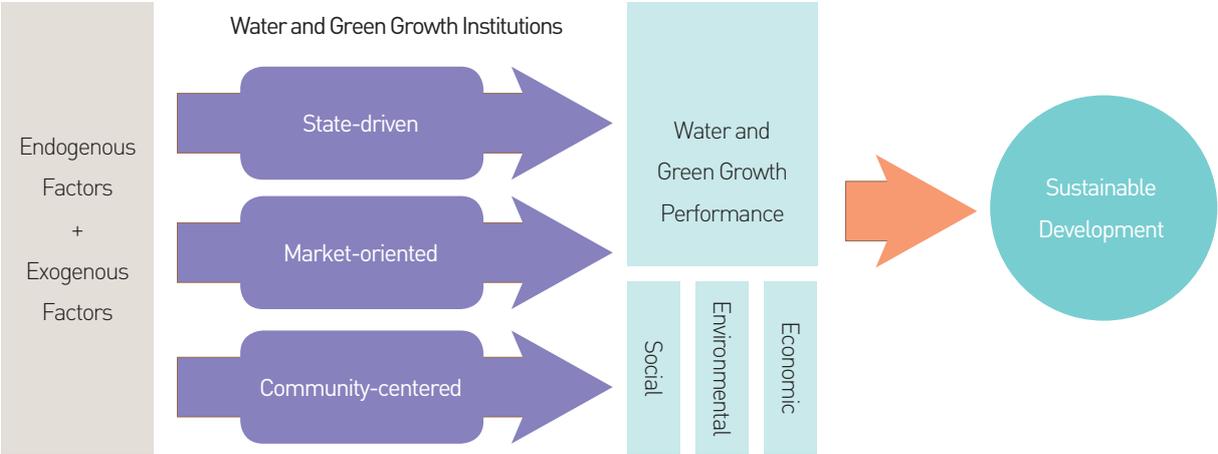


Figure 2-4. The Analytical Framework

participation. Figure 2-4 shows the analytical framework for assessing the performance of Water and Green Growth projects.

Evidence-based Approach: Phases 2 and 3

The evidence-based approach has been adopted to investigate the applicability of the WGG approach to various real cases in the field. The WGG Project selected 11 cases from 10 different countries. The case studies were conducted at different levels (e.g. project level, local level, regional level, and country level) to understand the applicability or limitations of the concept in different contexts. This project is useful in providing insight about the importance of water that is required for achieving sustainable development.

Water-related challenges in each country were identified, together with an assessment of policy implementation and performance through both quantitative and qualitative analyses. In the quantitative analysis, survey questionnaires were distributed to both experts and non-experts. In the qualitative analysis, international and local consultants were interviewed to acquire information on Water and Green Growth-related projects.

Case studies have been categorized based on different institutional change contexts such as state-driven, market-oriented, and community-centered. Then, the correlation between exogenous and endogenous factors, institutions, and performance were extensively analyzed. Specific and general policy implications were drawn from each case. Through these analyses, the WGG Project explored the pivotal role of water for economic development, environmental protection and social progress. WGG is applicable worldwide, but can be especially valuable to developing countries as a pathway to achieve sustainable development in an accelerated way.

The policy guideline (developed from policy framework in Phase 1) and the policy mix has been instrumental in establishing a policy implementation roadmap and recommendations. The evidence-based approach will be discussed thoroughly in the next chapter, providing vibrant, real-life illustrations and observations through case studies for how water can be a vector for green growth.



A person is sitting on a rocky shore, looking towards the camera. The image is overlaid with a teal color. The text is centered on the page.

CHAPTER 3

METHODOLOGY

This chapter will discuss how the Water and Green Growth Project Team (WGG Team) conducted 11 case studies and focuses on the methods used to derive major findings from the case study reports, questionnaires, and interviews. Using the strategic, institutional and evidence-based approaches, relationships among exogenous and endogenous factors, institutions and policy instruments, and performance are analyzed.

3.1 Research Steps and Aims

This chapter will discuss how the Water and Green Growth Project Team has conducted 11 in-depth case studies and will present policy instruments that were effective in each case. The first edition of the WGG report was based on an analysis of 26 international case studies and was launched at the 6th World Water Forum (Marseille, March 2012). As a follow up to Phase 1, this report has examined the 11 case studies to explore the extent to which appropriate water management policies have contributed to green growth. While it is difficult to generalize policy implications derived from the limited number of cases, the extensive nature of case study analyses that cover variety of contexts, challenges, and regional particularities will help policy makers and water experts to prepare and implement green growth policies, especially at diagnostic stages by referring to cases that suit their needs. Plus, policy guideline and policy mix that can serve as policy directions at a more general level are suggested. The WGG research was conducted in three phases: developing the concept, conducting case studies and carrying out analyses. These phases are shown in Figure 3-1.

The phases encompassed a number of strategic steps in order to achieve the project objectives:

- 1) To conceptualize the Water and Green Growth approach that emphasizes the role of water for economic growth, environmental protection, and social development;
- 2) To develop a theoretical approach and analytical framework for the analysis of case studies;
- 3) To identify individual case studies selected through consultations and expert workshops as good examples of the Water and Green Growth;
- 4) To conduct the pilot case study on Lake Sihwa in Korea;
- 5) To conduct 10 other in-depth case studies based on the analytical framework developed;
- 6) To draw lessons from each case study based on common questionnaires and interviews;
- 7) To derive policy implications from each country's context;
- 8) To provide policy options for decision-makers on Water and Green Growth and related policy measures.

The 11 cases were identified for in-depth analyses. Among the 11 case studies, nine were conducted by international experts from two institutions, the London School of Economics and Political Science, and Nautilus International Development Consulting, Inc. The two Korean case studies were conducted by the Center for Water Policy and Economy at K-water Institute. It was not possible to examine some of case studies at the same level as some projects were implemented at the national level (e.g. Brazil) and others were implemented at a regional level (e.g. Ebro River Basin in Spain, Gujarat State in India, and Golden Horn

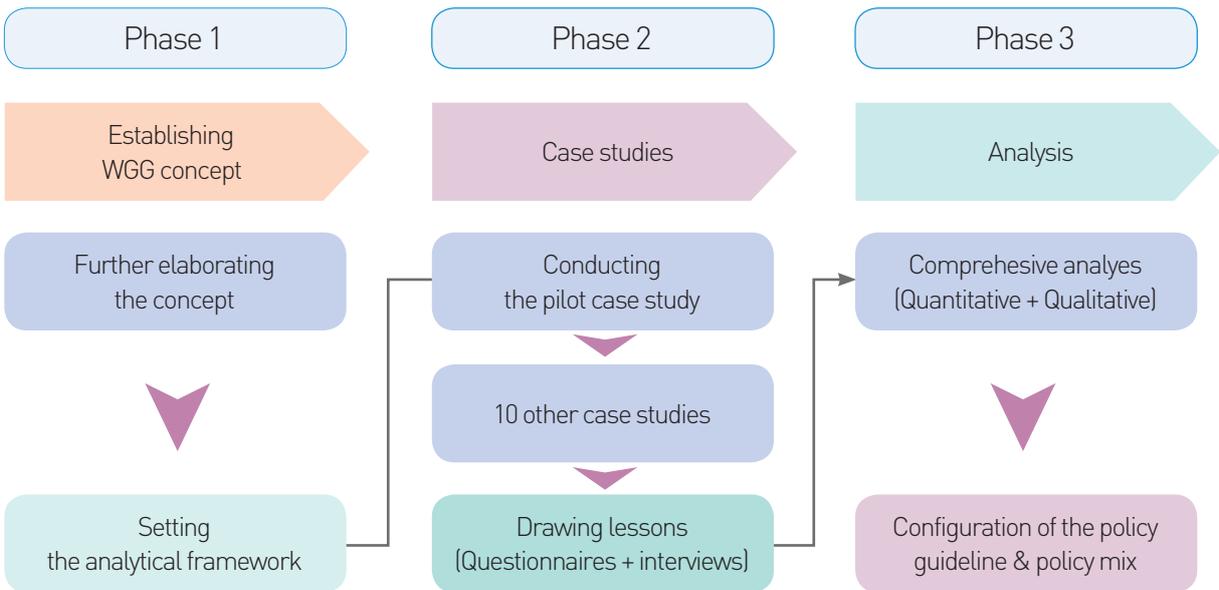


Figure 3-1. The Phases of the Research for Water and Green Growth Project

in Istanbul, Turkey). The case studies also vary in terms of scale. Some are aggregated from a few projects (e.g. India, Turkey), and others are implemented at the river basin and regional levels. While it is not easy to develop a policy guideline that could be applied universally, it was our objective to provide a tool that will help policy makers choose suitable policy strategies in light of their national specificities and local contexts.

The 11 cases that were selected, as presented in Box 1-1 in Chapter 1, generally conform to two requirements. The selected cases had to demonstrate economic growth, environmental protection, and social progress while emphasizing the role of water in achieving these three pillars of sustainable development (the conceptual requirement). The 11 cases scored a minimum in each of the three dimensions (a scale of 1 to 10) and exceeded a minimum overall score to be considered a WGG case (the operationalized requirement). Such evaluation was conducted with surveys of experts and other related personnel. When identifying the case studies, different project types and regions were also considered in order to draw from a wide diversity of experiences to consider both their relevance around the world as well as each region's particularities (e.g. level of development and endowment of water resources). The project type categories included: water resources development, water supply, water allocation, sanitation, power generation (hydropower/tidal power), water front development, flood control, ecosystem services and restoration, and others. The cases were selected from across regions of Africa, Americas and Caribbean, Asia and Caucasus, Australia and Oceania, Europe, and Mediterranean and Middle East. The analysis found that the cases possessed some common elements, which allowed them to be comparable.

This report aims to suggest a set of policies that can help policy makers attain the objectives of Water and Green Growth successfully. The policy framework developed in 2012 has been modified, based on 11 in-depth case studies, which deal with diverse regions and multiple aspects of Water and Green Growth. The outcome of the analysis will shed light on how institutional changes have influenced the behavior of actors and overall performance within the different exogenous contexts. The revised policy guideline with policy directions are highlighted as the main outcome of the project.

3.2 The Analytical Framework

Establishing an appropriate analytical framework is critical to evaluating the extent to which past projects, which have already accommodated the basic principles of Water and Green Growth, have been designed and implemented in the course of institutional changes. Following the original selections of case studies based on conceptual and operationalized requirements on three pillars of sustainable development (economic growth, environmental protection, and social progress), the WGG Team adopted the institutional framework from the work of Saleth and Dinar (2004; 2005) which employs the Institutional Decomposition and Analysis (IDA) Framework. The IDA Framework deconstructs water institutions, consisting of water law, water policy, and water administration, and evaluates the extent to which water institutions have evolved and changed in interactions with endogenous and exogenous factors. Using this framework as a platform, the study reinforces the analytical framework by paying special attention to those social, economic,

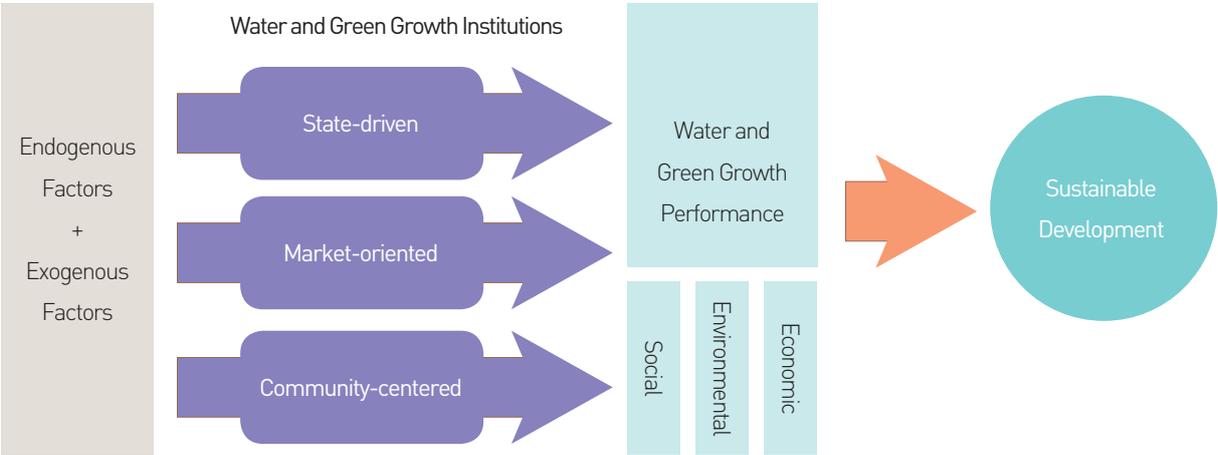


Figure 3-2. The Analytical Framework

and political aspects that influence the institutional changes of Water and Green Growth.

The institutional approach investigates the relationships and interactions among exogenous factors, institutions, policy instruments, and performances of the projects (see Figure 3-2). Within the framework, water-related laws, policies, and organizations can be revised, amended, and reshaped to align more closely with Water and Green Growth principles, ensuring that economic, environmental, and social elements are fully taken into account. Policy makers supportive of implementing WGG projects in their countries must be aware of both the successes and limitations of such initiatives, but also of the enabling environments that influence these outcomes. For instance, economic performance can be influenced by many exogenous factors such as demographics and level of development. Economic performance varies from country to country, and some of that variation is a result of different institutions that support or hinder project implementation. Some of exogenous factors are shown in Table 3-1. The analytical framework and its components are described in the following sections.

The exogenous factors indicate external conditions under which institutions evolve and policies are implemented, some of which are listed in Table 3-1. Exogenous factors in this study include economic, social, political, environmental and technical ones. Economic factors indicate the general economic situation of the country or region. These include economic growth, national wealth, demographics, and population concentration within urban areas. Social factors include social equality,

gender equality, education, health, and national or regional employment. Political factors indicate political stability and the perceived level of corruption. Environmental factors include environmental regulatory regime, vulnerability to natural disasters, and the endowment and quality of natural resources. Also, technological progress and adoption of technology are considered as technological factors.

In order to explore which policy instruments have been employed and effective, it is necessary to understand Water and Green Growth mechanisms. This begins with an understanding of the types of actions and actors within society that contribute to sustainable development through economic, environmental and social dimensions. Most activities in society are conducted by three general types of actors: the state; the market; and the community. In this report, the definition of community refers to civil society and what is called self-organizing networks (Rhodes 1996, p. 660; Jessop 1998, p. 29; Stoker 1998, p. 23).

Conventionally, the water sector has been dominated by the state, the single actor advocating the assumption of water as a public good, which left little room for any other social actors in decision making and implementation. But over the last few decades, non-state actors have increasingly contributed to the water sector as a whole in forms of private sector participation and through the emergence of civil society. Although policies are generally created and implemented by the state and administrative agencies, it is not uncommon to witness an “outsourcing” of water-related policies, programs, and services to non-state actors in many countries, both developed and

Table 3-1. Examples of Exogenous Factors

| Exogenous Factors | |
|--|---|
| Economic Factors <i>(with examples of indicators)</i> | Economic growth, national wealth, demographics, population concentration within urban areas <i>GDP per capita, population density, urban population (% of total)</i> |
| Social Factors | Social equality, gender equality, education, health, employment <i>Gini coefficient, women’s labor participation rate, education enrollment rate, Human Development Index, wealth concentration rate in cities</i> |
| Political Factors | Political stability, level of corruption <i>Corruption Perceptions Index</i> |
| Environmental Factors | Environmental regulatory regime, vulnerability to natural disasters, natural resources endowment <i>Water quality (BOD), level of biodiversity</i> |
| Technical Factors | Technological progress, adoption of technology <i>R&D expenditure (% of GDP), number of patent applications</i> |

developing countries. Therefore, water-related laws, policies, and organizations³⁾ have co-evolved in accordance with such trends, which entails particular policy approaches. In this report, such approaches are categorized as state-driven, market-oriented, and community-centered institutions. This provides an overview of the changes of architecture in water policy-making and implementation in a more holistic manner that is more inclusive in recognizing the influence of stakeholders other than the state. Therefore, Water and Green Growth institutions (related laws, policies, and organizations) have been reorganized into state-driven, market-oriented, and community-centered institutions. These changes are often affected by exogenous and endogenous factors.

3.3 Institutions and Policy Instruments

Table 3-2 illustrates examples of three different types of institutions and policy instruments that were identified in the case studies or are instrumental to achieving Water and Green Growth.

Some of these instruments are described in more detail in the following pages. These include water laws and regulations, indicative plans for water development and management, subsidies, taxes and environmental pollution charges, technology promotion policy, cost recovery, private sector participation, tariffs and user fees, water rights trading, stakeholder participation, coordination mechanisms, access to information and IWRM.

3.3.1. State-driven Institutions

As the key player in policy making and implementation, the state is equipped with a myriad of policy measures that can be selected depending upon different political and economic situations. Among the state-driven institutions and policy instruments presented in Table 3-2, four of them are discussed in this section: water laws and regulations, indicative plans, fiscal policy and technology promotion policy. According to analyses based on questionnaires and interviews from the case studies, these policy instruments below have been identified to be more effective than other state-driven institutions.

Water Laws and Regulations

Laws and regulations include sets of rules issued by governments that control behavior, enforced together through policing institutions and penalties for failing to comply. Regulations encourage or restrict economic activities through the legal system, i.e. granting licenses or permits and regulating the labor market. But the purpose of regulation is not only to dissuade people from certain behaviors, but also to encourage other behaviors by providing incentives. Most regulations work effectively in establishing compliance among affected populations, provided that the rules are reasonable and enforced. Regulations work even more effectively when the rules are established in consultation with affected populations. A variety of regulations is

Table 3-2. Water Institutions and Policy Instruments

| | State-driven | Market-oriented | Community-centered |
|-----------------------------------|--|---|---|
| Institutions & Policy Instruments | Water laws and regulations | Cost recovery and water pricing | Stakeholder participation |
| | Indicative plans | Payment for ecosystem services (PES) | Conflict resolution & Coordination mechanisms |
| | Fiscal policy (e.g. subsidies and taxes) | Water rights trading | Access to adequate and relevant Information |
| | Technology promotion policy | Private sector participation policy (For investment or/and operation) | Accountability provisions & arrangement |
| | Balanced administrative layers and functions | | Integrated approach (IWRM) |
| | Spatial organization of water administration | | |

3) Saleth and Dinar (2004) categorizes water-related institutions into water-related laws, policies, and administrations. Given that the recent trend in water governance is shifting from a state-centric one to more inclusive one where non-state actors have larger roles and participation, the report changed "administrations" into "organizations".

produced through a bargaining process between the government and industrial players. Government ministries or departments, which are responsible for water and sanitation services, are not the only actors. Other government agencies, political parties, utility managers, labor unions, NGOs, and consumer associations may also be involved.

In water and sanitation services, there are a number of elements in the regulatory regime. For example, a first category encompasses the general framework of laws, constitutional rules, policies, and administrative structures within an economy that influence water and sanitation programs. The framework includes the labor law, company taxation rules, currency controls, and the division of responsibilities between national, regional, and local governments. A second category indicates water resource and environmental laws, water rights allocation and protection mechanisms, and the performance of any resource conservation or pollution control agencies. The third category covers specific water and sanitation sector regulations, e.g. the legislation enabling private sector participation, the power of any regulatory agencies, regulatory tools, and mechanisms for public consultation. The last category is related to individual contracts or licenses under which the companies operate (Rees, 1998).

In the case of Water and Green Growth, regulations can be combined with incentives to restrict economic activities that cause pollution, for example, or to promote green practices. Regulations influence green growth in the following areas: production efficiency, measured by resource efficiency and the amount of by-products; product market competition; international trade and foreign direct investment rules; and private sector voluntary initiatives. Effective regulations include

performance and technology standards, which are useful for reducing negative externalities when market prices fail to reflect some of the cost of economic activities. Some examples from the case studies are presented in Box 3-1.

Indicative Plans

Centrally-planned states can regulate the economy through measures such as production quotas and minimum production requirements. This is regarded as directive or mandatory planning. Also, states can give a great deal of room for the market to function on its own. As a hybrid form of state-led planning, indicative planning, or planning activities that are based on economic analysis, serves to analyze the economy and then make this information available to industry, the private sector and other actors in order to establish socio-economic development plans. Indicative planning can strengthen the implementing power of socio-economic development plans, because the state takes into account various factors from the initial stages of indicative planning, including socio-political concerns, budgets, human resources, and the level of technological advancement. States can then allow the economy to run its own course with little intervention.

Governments may draft plans, and put in place policy instruments, such as subsidies, taxes, or technical or environmental standards, to spur investments in a particular direction. For Water and Green Growth, governments can, for example, draft a plan of developing waterfront areas in environmentally friendly ways. Water planning ensures that society has access to an adequate quality and quantity of water resources and to public spaces around water bodies.

Box 3-1. Water Laws and Regulations

a. In Korea, when Lake Sihwa was polluted, environmental regulations were not strictly applied. *The Water Quality and Ecosystem Conservation Act*, Chapter 4, Article 6 was established in 2007, which was applied to the area surrounding Lake Sihwa. Today, the companies that exceed their pollution and discharge quotas may be forced to suspend operations, to close their facilities, or to be subject to fines. Regulations contributed to changing business-as-usual behaviors such as discharging untreated wastes. It will help conserve ecosystem services.

b. The Turkish government and municipalities have adopted environmental measures to reduce air pollution and pollution from ships and energy sources such as fossil fuel-based power plants. Several regulations on the release of large quantities of oil and emissions from transportation systems have been issued by the government with an aim to restore marine ecosystem services. Ships that carry hazardous materials are required to report to the Environment Ministry of Turkey, and the government also supports alternative measures to transport oil and gas, such as through the Caspian oil pipeline route. Regulations by the Turkish government are powerful tools to put more emphasis on the importance of water, encouraging not to discharge pollutants in the sea contributing to protection of environmental services.

Box 3-2. Indicative Plans

a. The Egyptian government initiated the *Integrated Water Resources Plan* in 2005 with an emphasis on water supply. *The IWRP 2017* has introduced desalination technology as a means to augment water resources and includes a strategy to expand an amount of marginal-quality water from 10% in 2000 to 17% in 2017. The organized plan of the Egyptian government boosted development of innovative water technology as an engine for growth.

b. In Brazil, the 1988 Constitution provided the legal foundation for the National Water Resources Management System, including water management practices, economic tools for water management and public participation in the decision-making process. In 1997, the *National Water Resources Policy*, known as *the Water Law*, was promulgated and provided the mandate for the establishment of the National Water Agency of Brazil (ANA) in 2000. The concept of water management and instruments has been established with the enactment of the *Brazilian Water Law*. Well-organized indicative plans provide implementers with accountability to implement green growth policies.

c. Spain adopted a basin management approach to the Ebro River Basin in 1926, and it is one of the oldest continuously managed river basin in the world. The most recent *Hydrological Plan* for the Basin was launched in 2014 in response to *the EU Water Framework Directive*, and to *the 2001 Spanish Water Act*. The plan has influenced the implementation of water planning and management in the Ebro River Basin. A variety of positive impacts from regulatory activities have been identified, i.e. improvement in wastewater treatment, upgrades in distribution networks and improvements in water quality and domestic water supply. Water planning is one of the key instruments to use water resources effectively and to meet the demands of different water users. Water planning aims to achieve economic growth, environmental protection, and social development through conservation and building infrastructure.

d. In Korea, the Ulsan city government embarked on an array of local development projects in 1997 and set the goal to build eco-city as a means to tackle environmental pollution. The city established the *Ecopolis Ulsan Declaration* and the comprehensive plan of *Taehwa River Master Plan* in 2005 in order to create water-friendly space and improve water quality. The project entailed flood protection, construction of waterfront areas, and environmental rehabilitation. The purpose of the plan was to prioritize the Taehwa River Restoration Project and to encourage local companies, social organizations, and local residents to form a multi-stakeholder mechanism for decision making. Stakeholder participation builds governance and institutional capabilities to implement Water and Green Growth policies.

Responsible water planning can mediate conflicts over water resources and prevent various sectors from overexploiting water resources. Moreover, responsible water planning promotes a constructive approach to tackling *the tragedy of the commons*, i.e. by providing incentives for the protection of water and watershed areas. Water plans are often top-down, supported by a central authority. The mandate and resources are embedded in water plans, which is necessary to allocate water fairly among competing uses, to provide adequate water and sanitation services, to respond to water scarcity, to regulate water quality, and to address climate change issues. From the perspective of Water and Green Growth, effective water plans manage water resources to support diverse water users including industries and the public, to preserve ecosystems, and to reduce economic and social vulnerability. Box 3-2 provides examples of planning instruments and describes the indicative plans used in some of the case studies.

Fiscal Policy

Public Funding and Subsidies

Financing is a prerequisite to implementing Water and Green Growth policies efficiently and effectively. Financing is needed to build sustainable and resilient infrastructure, to promote economic growth hubs around water bodies, to provide water and sanitation services, to assist populations to adapt to climate change, and to provide incentives for business and for the adoption of green technology. The state plays a pivotal role in cementing financial capacity for water projects. Many of the case studies demonstrated major government commitments and significant investments in water-related infrastructure.

Many infrastructure projects, including those for water, are dependent on public funding, and the prioritization process for obtaining financing for public projects hinges upon political bargaining between various stakeholders in decision-making

processes. Such a process is often influenced by the discourse on the extent to which the international community can ensure greater sustainability for the planet in future. For instance, there is growing recognition that perverse subsidies that encourage continuous exploitation of fossil fuel sources for economic growth should be phased out or removed.

Taxes and Environmental Charges

The process of creating new tax items or increasing water pricing rates requires a painstaking political process in which numerous stakeholders, including companies and civil society, participate and reach a consensus. *The polluter pays principle* in the Water and Green Growth context is a market mechanism to recover costs for damage incurred to the environment, notably to water ecosystems, by charging fees to those who caused the pollution. It is aimed at improving water quality and treating wastewater adequately. Also, charging fees to polluters can contribute to improving water quality by encouraging polluters to reduce discharges so that they will no longer be subject to fees (European Environment Agency, 2011).

In contrast to financial support (subsidies) from the government, taxes and environmental charges incur monetary costs to companies and organizations. For example, polluter fines or taxes are established to discourage polluters from discharging pollutants into the environment. In many countries, water taxes are adopted, often as a means to ensure the cost of basic services to those who cannot afford to pay for them. However, these policy options cannot be regarded as direct cost recovery mechanisms. Once collected, they flow into the general treasury. Taxes may be applied indirectly to support environmental restoration or

maintenance. These taxes and environmental charges are often more effective in changing behaviors than regulations, and the resulting tax revenues at the national level can reduce pressure on providing the national budget revenues (Mirrlees et al. 2011, p.231). Some examples of taxes and environmental charges used in the case studies are presented in Box 3-3.

Technology Promotion Policy

An appropriate technology policy can entail the establishment of well-defined and realistic technology targets in order to achieve national objectives in regard to research and development (R&D). Thus, particular sectors, such as water, and specific technologies, such as those in agricultural efficiency, should be considered as supporting green growth strategies, rather than setting a goal to raise the national technology level in general. A good set of policies to promote technology serves to provide innovative solutions for resolving complex future water challenges compounded by climate change. In the long term, supporting R&D programs will provide a special emphasis for the promotion of specialized technology development. The recent trend of R&D in the water sector involves the provision of brand-new solutions that combine water technologies with non-water ones.

The establishment of these well-defined plans can be further supported by providing subsidies and incentives for technology development, supporting research institutions, promoting technology transfer, and adopting standards. Promoting innovation and developing technology may require a long-term investment in basic and fundamental technologies, which may not yield local commercialization of such technologies in the short term. Some examples are provided in Box 3-4.

Box 3-3. Taxes and Environmental Charges

- a. River basin committees such as Paraíba do Sul and PCJ in Brazil have passed water and sewage tariffs based on water-use and sewage treatment efficiencies. Therefore, water users are charged based on their water consumptive use, and sewage is charged based on the released volumes and on the Biochemical Oxygen Demand (BOD) abatement level. Therefore, large industrial and sanitation users prefer investing in technologies that reduce water consumption and increase sewage treatment levels, rather than paying increased tariffs for over-consumption.
- b. The city of Loja, Ecuador, has issued a municipal ordinance that put in place a special consumption tax on water in order to help finance the conservation of water resources. The collected amount of tax is deposited in a special account that generates approximately US \$300,000 every year. The funds are then used to finance conservation initiatives, environmental awareness programs, and reserve management. This has been known as an environmental charge in household water bills. It can contribute to restoring ecosystem services and securing financial sources at the same time.

Box 3-4. Technology Promotion Policy

a. The Egyptian government initiated *the Integrated Water Resources Plan 2005-2017* and *the Desalination Technology Roadmap 2030* in order to ensure reliable water supply. *The IWRP 2005-2017* had identified the scaling-up of desalination technologies as a means of becoming more water-secure. In addition, Egypt planned to increase its official reuse of marginal-quality water from 10% in 2000 to about 17% by 2017. Innovative technologies contribute to job creation and economic development. It can also close the gap between water supply and demand, thereby increasing water efficiency.

b. The State of Gujarat in India has established a state-wide water grid, and other important large-scale engineering infrastructure for water resources development and management. Also, as a result of water sector initiatives such as the construction of large numbers of check dams in villages and the adoption of micro irrigation systems, and thus water security, socio-economic security, and environmental sustainability, have been improved. Green technology such as micro irrigation systems can be adaptive solutions for sustainable development.

3.3.2. Market-oriented Institutions

The market-oriented economy operates largely on the basis of supply and demand for goods and services, with less intervention from the state. Actors in the market, such as companies, enterprises and consumers, are influenced by market instruments, including prices.

Although the market-oriented economy appears to be sound in terms of its own viability, the policies favoring market principles do not necessarily produce positive outcomes. Such disappointing outcomes stem from the circumstances in which the fundamental market principles are not working properly, e.g. difficulty in providing products and services based on supply and demand or controlling supply and demand based on pricing mechanisms. In these cases, market mechanisms do not necessarily guarantee the best policies or solutions in society. When several policy measures are selected under a strict market-oriented framework,

it is crucial to take into careful consideration the effectiveness of the essential instruments of the market mechanism, including supply and demand and pricing.

Market-oriented policy and economic instruments can be applied in managing ecosystem services (UNEP, 2011a). Payments for ecosystem (or environmental) services (PES) and an increase of trading permits are examples of such instruments. This section will examine the tariffs and water pricing, water rights trading, and private sector participation. These market-oriented institutions appear to have had influential impacts on the success of WGG projects.

Cost Recovery and Water Pricing

There is growing consensus that the service costs for water resources management should be recovered based on the application of the cost recovery principle, although not

Box 3-5. Cost Recovery and Water Pricing

a. ISKI (Istanbul Water Sewerage Administration) is responsible for all water and wastewater infrastructure in Istanbul, Turkey, including treatment plants. The revenues obtained from the collection of water tariffs cover almost the institution's entire operating budget. Water tariffs in Istanbul are determined by ISKI based on the full capital and service cost recovery principle. The tariff covers wastewater treatment costs in line with the polluter pays principle of *the EU Water Framework Directive*. Payment for ecosystem services helps to raise awareness of how the behaviors of the people are connected to freshwater ecosystems. In the long term, it is also important in generating the willingness of people to support environmental restoration.

b. In Nepal, the AHRE (Andhikhola Hydel and Rural Electrification) Project set the goal of reducing costs in order to set a lower electricity tariff that would be affordable to the local consumers, while, at the same time, generating a sufficient level of income to cover operation and maintenance expenses with some remaining funds for reinvestment. This approach, thus contributed to both the social and economic sustainability of the project.

c. In the case of Lake Sihwa, Korea, part of the costs shouldered by the local and central governments are met through tax sources or sewage treatment fee collection. (Other costs, such as for maintenance of the river, cannot be claimed). K-water began to recover costs for the Sihwa District Development Project, including for the improvement of water quality, by parceling and selling the reclaimed land and through income generated by the operation of the Sihwa Tidal Plant. This cost recovery structure enabled the continuation of the water quality project, which requires a large investment.

necessarily full cost recovery. In general, full cost recovery is not a popular policy option, often due to the principle that water is a basic human right and a common good that should be available to all. However, the virtue of cost recovery lies in the fact that the policy measure can enable a better quality of water services and serve as a tool to secure economic sustainability (Jasper, 2003a). A high degree of dependence on the national budget often discourages development of operational responsibility at the local, river basin, and national levels. Special attention should be paid to introducing the cost recovery principle in the water sector using various methods in order to ensure sustainable water management in the long run (Jasper, 2003a).

Water Rights Trading

Since the concept of water rights varies among countries, there is no single definition of water rights. Hodgson (2006) explains that water rights can be interpreted in different ways according to the circumstances and jurisdiction where it is defined. In general, a water right is a legal claim to access to a water source, including rivers, creeks, lakes, and groundwater resources. In addition, such a water right often includes flowing water, as well as the right to static water itself.

Water trading, or water rights trading, practiced in Australia (see Box 3-6), often emerges in the discourse on water rights as an example of a market-oriented instrument. Trading water rights indicates the transfer of the right to abstract water among users in the market, rather than trading the water commodity itself. However, water rights can be abused if land leases are not included in water rights trading. To prevent conflicts with new landowners, the Australian government does not allow the ownership of water to those who do not actually own the land.

Private Sector Participation Policy (for Investment or/and Operation)

Public-private partnerships (PPPs) are recognized as offering feasible solutions to complement or replace public responsibilities for water management, water supply, and wastewater treatment services. This option can pave the way for the state to fulfill management, financing, and technical needs by resorting to private players in the market. Some examples are presented in Box 3-7.

There is a vast array of PPP models depending on the size and type of the projects. In terms of water-related projects, the modalities of PPPs vary case by case, especially in the water supply and sanitation services sector. PPPs can be understood as a legal agreement between the public and the private sector so as to share risks and benefits when embarking together on infrastructure development. This implies that PPPs share objectives and shortfalls between the public and the private sector, from the beginning to the end of contracts (Ouyahia, 2006). However, it is important to note that PPPs do not necessarily solve all the challenges in the water and wastewater sector. Successful PPPs still depend on the capacities and efficiency of public utilities and adequate public investment to meet communities' needs. In addition, there are no guarantees that PPPs will indeed lead to the successful enhancement of water and wastewater services (Rees, 1998).

Policy directions for water PPP projects depend on the type of collaboration selected by the government and the private sector players. Drawing from the broad range of arrangements that exist, it is important that a balance be struck in PPPs in which the decision making, investments and returns are shared in an equally beneficial way between the partners. The World Bank (2009) suggests that water PPP projects should enhance the

Box 3-6. Water Rights Trading

In Australia, surface water and groundwater have been in the public domain since 1985. In order to use water, users need to obtain a license from the River Basin Authority. To issue a license, a previous water use allocation must be considered under *the River Basin Management Plan*. The system did not allow newcomers to have access to water resources already allocated to other users. Consequently, a new instrument, the water right transfer contract (private temporary agreements), was introduced with *the 1999 Water Act* reform. The introduction of the cap in the Murray-Darling Basin by the central government has, therefore, drawn focus to the efficiency of water use and the trading of water rights to the highest value use. The volume of water rights trading has escalated. Water trading has proven to be a useful tool in helping water users, particularly irrigators, to respond to changes over the past decade.

Box 3-7 Private Sector Participation Policy

a. The AHRE (Andhikhola Hydel and Rural Electrification) Project in Nepal is owned by the Butwal Power Company Limited (BPCL), a private company established in 2003 that is in charge of operating the project. The BPCL efficiently runs the project using a pro-poor electric utilities policy in the region. For example, cut-off devices have been put into service in order to limit the maximum consumption in each household, while ensuring a minimum basic service to the poorest customers. Such a fixed tariff system also reduces costs by eliminating meter reading. These different tariff structures enable BPCL to supply electricity to different strata of the rural communities. Operation and maintenance by the private companies improve efficiency and provides sustainable financing sources.

b. The rapid economic development between 2000 and 2010 in Pudong Shanghai, China, resulted in worsening water quality and pollution-induced water shortages. Such phenomena prompted the municipal government to adopt an unconventional approach, since one of the most feasible options to remediate the situation was to invite private sector players to provide the services. Following an international bidding process, Veolia Water was awarded a contract in 2002 and agreed to invest about US \$240 million in exchange for 50% equity in the Shanghai Pudong Water Supply Corporation. Direct financial investment from the private sector enabled the government to meet the growing demand for good quality drinking water of the residents in Pudong.

quality of water services and the efficiency of operations via private operators. The water-related PPP option is attractive to many countries, particularly developing countries, in terms of securing cutting edge technologies, advanced management know-how, and financing. Countries that introduce PPPs to the water sector must ensure that an adequate institutional setting is established prior to inviting private sector players to become involved.

3.3.3. Community-centered Institutions

A prerequisite to achieving Water and Green Growth is to involve the people in decision making for water management in areas where they are directly affected. For example, river basin organizations are making an effort to accommodate a wide range of diverse opinions and critical comments among the various stakeholders. This approach is the foundation on which policies, programs, and projects can be implemented effectively. Water is a local issue and engages a number of stakeholders at the community, municipal, river basin, regional, national and international levels. The lack of suitable structure and mechanisms to accommodate competing demands for water across policy areas and among different levels of government can lead to the creation of barriers and limited communication among diverse entities. The community-centered approach to water management, therefore, urges the state, which has played a predominant role in water management, to undertake a policy shift to a more accommodating and flexible approach by collaborating with different stakeholders, in order to tackle formidable water challenges compounded by climate change. Community support is also needed for private sector and public-private partnership initiatives to function effectively.

Stakeholder Participation

Stakeholder participation is a condition that makes water resources management and governance more effective. Ideally, decisions are made after all interests have been considered or at least after stakeholders were given the opportunity to express themselves. Instrumental in planning, monitoring and enforcement, this type of stakeholder participation platform should facilitate the creation of environmental, institutional, social, technical, and financial sustainability. This platform helps to find a common ground within conflicting interests in the process of water resources planning and the implementation of water development. In addition, the platform reinforces efforts towards conflict prevention and resolution (Jaspers, 2003b).

However, it is still uncommon to find adequate institutionalization of stakeholder participation in water decision making and implementation in the world. This delay in the institutionalization of public participation might be due to reticence of decision makers responsible for water policy to adopt anything other than a business-as-usual approach. Bureaucrats often believe that more engagement with the public might slow down decision making and implementation, which can spawn an increase in transaction costs. But it has been shown that consensus-building through the public participation approach can actually guarantee smoother and more cost-effective development of projects and policies in the water sector.

To make governance more effective, it is imperative to involve as many stakeholders as possible at various levels. A broad range of participation offers diverse benefits: 1) encouraging

exchanges and debates on new ideas and information; 2) identifying issues that should be addressed or may have been overlooked; 3) specifying the technical and human capacities necessary to address them; and 4) reaching a consensus on the need for collective action that spurs effective implementation. The government may play a key role in this process, but the more crucial element is to establish a multi-stakeholder processes, regardless of the facilitator. The processes should include a variety of stakeholders, i.e., decentralized authorities, the private sector, and civil society. It should seek to involve to a greater degree underrepresented affected stakeholders, such as women, youth or indigenous populations. Transparency and accountability can be improved through good communication and information mechanisms (OECD, 2001). Access to information is crucial; water data held by government agencies need to be accessible.

Stakeholder participation can be facilitated in a variety of ways, such as through education and training programs, reinforcing open communication and public forums, and raising public awareness. These methods can lead to a better understanding of critical issues among stakeholders and enable them to address challenges and suggest alternatives to inadequate water policies. For instance, stakeholder dialogues address the impacts of large-

scale water infrastructure projects like dams on the environment and human activities. By reinforcing exchange and communication on potential projects amongst a variety of stakeholders and evoking many different options, a better, more socio-economically and environmentally sound outcome can be reached in a collaborative way, resulting in general positive support. Examples of stakeholder participation are shown in Box 3-8.

Access to Adequate and Relevant Information

The general public should enjoy the right to easy access to adequate and relevant information. Improving transparency in access to information can minimize possible conflicts and play a significant role in helping to reach a consensus in society. State-of-the-art information technology enables states and people to gain easy and immediate access to relevant information and data, as illustrated in Box 3-10. To make information available to the public is crucial in implementing water-related projects at the national and regional levels. The general public should be guaranteed easy and affordable access to all kinds of information on Water and Green Growth projects, i.e. on the preparation process, activities of the implementers, and proceedings of meetings.

Box 3-8. Stakeholder Participation

a. The Murray-Darling Basin Authority (MDBA) in Australia has a requirement to consult with the Basin states, the Basin Community Committee and the Basin Officials Committee for deciding on important issues, including river basin planning. To encourage stakeholders to participate in developing the draft Basin Plan, the engagement process must: 1) develop a process that tracks and collates over 3,000 pieces of feedback on the "Guide to the Proposed Basin Plan"; 2) publish an overview of feedback on the Guide; and 3) implement a round of community information sessions to discuss the Guide. In the MDBA, a full range of stakeholders participated to coordinate conflicts; well-coordinated institutions made it possible to implement green growth policies in practice.

b. In Nepal, the local community and Village Development Committees were involved in developing many innovative approaches. Local communities were informed of diverse problems and trained to understand electricity. Hundreds of local people gained skills during the construction period. The Users' Organization (UO) was encouraged and stimulated community commitment. The UO contributed to raising awareness, encouraged vulnerable people to participate in community development activities and served as a communication link between the community and BPCL. Despite these efforts, women's participation was not as strong as it should have been. It is likely that the involvement of women in project management would have enhanced community development, project outcomes, and the empowerment of local women, thereby enhancing social growth.

c. As of 2013, a total of eight river basin agencies had been created in Brazil, all of which are operational. The effective implementation of the river basin committees and agencies has contributed to increasing incoming amounts of funds from water use charges, thanks to the emerging awareness of ecosystem services. In particular, the Water Provider Program has enhanced the capacity of the river basin organizations by providing training courses on best management practices (BMPs). Encouraging people to participate in the decision-making process from the initial stage will improve social development.

Coordination Mechanisms

Coordination mechanisms should serve to improve disconnects occurring due to vertical fragmentation, i.e from one level of government to another (local to provincial/state, national or international), or horizontal fragmentation, i.e among different government agencies of the same level, such as those dealing with agriculture, forestry, fisheries, water, mining, municipal affairs, or regional development) (Mitchell, 2005). The efforts of some countries to develop integrated water resources management plans were intended to improve institutional decision making in water, but the plans often did not include coordination mechanisms.

Some good practices demonstrate effective cooperation mechanisms under multi-agency based water management structures. The mechanisms tend to work through Task Forces, Working Groups or Committees based within independent organizations at the central, river basin, and local levels. Such new institutions must rely on the already existing institutional landscape

and extensive experience in the water management sector. More importantly, they should remain flexible and transparent in their efforts towards consultation and public participation in order to accommodate different voices from society. Some examples are shown in Box 3-9. However, the establishment and implementation of coordinating mechanisms within the water sector, as well as for water within other sectors, is admittedly a very challenging job. The complicated backdrop of political economy in countries often prevents ambitious policy makers and water managers from taking further steps to achieve such a goal. Despite the evident need for cooperation among all stakeholders, the achievement of Water and Green Growth based solely on harmonized policies developed with the assistance of institutional coordination mechanisms was, is, and will be seen as a politically risky, socio-economically challenging, and environmentally complex task. It is, however, worth trying to reach such a goal in the long term, in particular when faced with a high degree of uncertainty due to climate change and other global crises. The need to develop adaptive institutions is critical.

Box 3-9. Coordination Mechanisms

- a. At the beginning of the Lake Sihwa's development in Korea, conflicts between government ministries were handled by formal government bodies such as the Office of Government Policy Coordinator. Informal consultative groups, such as the Sihwa District Sustainable Development Council (SDSDC), in addition to formal government bodies, played mediating roles. The discussions of the SDSDC are open to the public outside the council. It serves as a platform for people to discuss on the issues and share the progress. Green growth policy needs support from the public.
- b. In Turkey, there are non-profit organizations that support national policies. For instance, the Turkish Foundation for Combating Soil Erosion, Reforestation and Protection of Natural Habitats (TEMA) was founded in 1992 to promote the conservation of water resources and ecosystems. The NGO contributed to developing and coordinating campaigns to support the establishment of national policies for the sustainable use of lands and rational management of water resources. Likewise, the Regional Environment Centre (REC) is an independent international organization with 17 country offices that works with the government, NGOs, and the private sector, ensuring public participation, and information sharing in environmental decision-making processes. Participation of a wide range of stakeholders improves transparency of decision-making processes and brings about more satisfactory results.
- c. The Ebro River Basin Confederation in Spain (Confederación Hidrográfica del Ebro or CHE) has been working continuously for 88 years and has provided a coordinating mechanism for this vibrant and growing region. The Ebro River Basin Management Plan provides the framework for water management and responds to the European Union's Water Framework Directive (WFD), which calls for greater public participation than had originally been required by the CHE. The EU requirement for active public participation has resulted in an extensive public participation network that reaches all the sub-basins and serves as a forum for sharing information and fostering a common understanding of water challenges and measures to overcome them.

Box 3-10. Access to Adequate and Relevant Information

- a. The Ebro Basin Confederation in Spain supplies data to the general public through the Hydrological Information System (SAIH). The system provides real time data on the hydrological situation which are gathered from gauging stations (levels and river flows in the basin); reservoirs (levels, volumes and water filled percentage); irrigation systems; weather stations; precipitation; and hydrological forecasts. The SAIH provides detailed information from more than 700 stations located on geographical maps in the system.
- b. The outcomes of each council meeting in the Sihwa Water Quality Improvement Project in Korea must be uploaded on the council web page. This openness to the public has resulted in the production of more responsible policy measures. In addition, the public takes a role in the monitoring system to assess transparency in the decision-making process and during implementation.

3.4 Data Collection

To evaluate the performance of a project, questionnaires and interviews were conducted to collect data and arguments for the case study analyses. Two types of questionnaires were used: Type A was distributed to water experts such as project manager(s) or person(s) who had been directly involved in the management of a project with the most intimate knowledge of the case; Type B was given to persons or organizations with a competent knowledge of and legitimate connection to the project. Each questionnaire is divided into the 5 following sections: project overview, state-driven institutions, market-oriented institutions, community-centered institutions, and performance. The information from the completed responses was compiled and incorporated into the written case study by consultants. Moreover, the coded data from the questionnaires served as the database for econometric analysis.

In addition to questionnaires, each case study reflects opinions and insights from interviews with at least five experts who had a good understanding of the cases. The interviews were aimed at providing a more detailed and in-depth understanding of the projects based on the analytical framework of WGG. The transcripts of these interviews are available in *Volume 2 Case Studies*.

3.5 Measuring Performance

After data were collected, analyses was carried out with the analytical framework developed by the WGG Team which involves three elements: 1) exogenous factors and endogenous factors; 2) water institutions (state-driven, market-oriented, community-centered); and 3) related performance or outcomes. The exogenous factors broadly describe the national, regional, or local context in which a project or a set of policies have been implemented. These exogenous factors and endogenous factors may influence performance directly and indirectly together with the institutional factors that comprise water institutions.

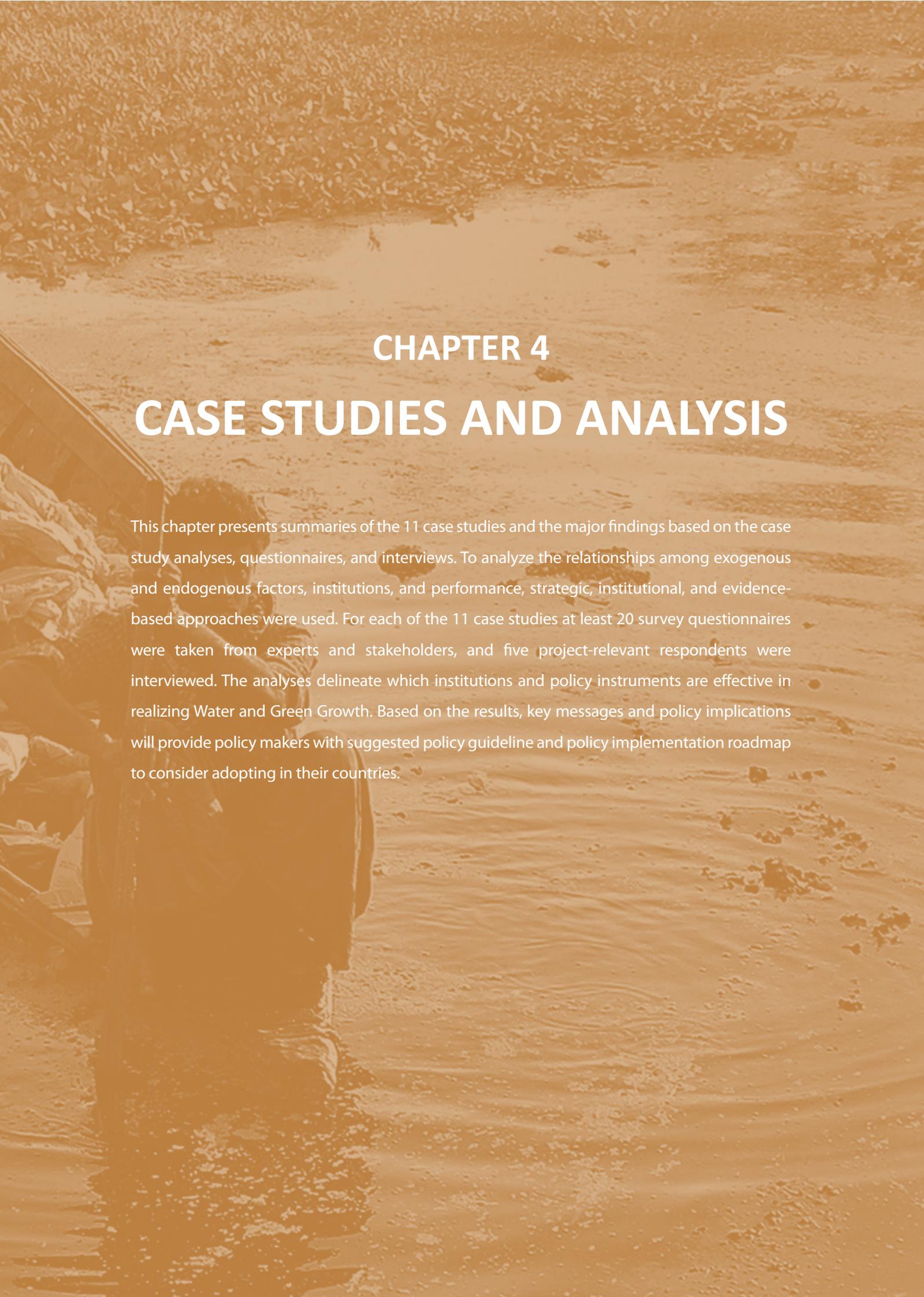
The Water and Green Growth concept outlines a new approach on how to achieve sustainable development. The researchers measured WGG projects performance according to the three dimensions of sustainable development (economic growth, environmental protection and social development). Performance was measured into four dimensions: managerial, economic, environmental, and social performance.

Managerial performance measures whether policies or projects are implemented within the planned timeframe and whether the cost of the project falls within budget. The managerial performance dimension also shows whether a project was appropriate or even necessary. The economic performance dimension appraises the extent to which the project resulted in increased wealth or production and net job creation. The environmental performance dimension assesses the extent to which the environment is restored from a state of degradation or the extent to which environmental resilience is maintained or strengthened with regard to economic or social activities. The social performance dimension evaluates whether basic needs are met, whether livelihoods, education, and health are improved, if equity is increased thanks to the project, and if stakeholders are aware of the issues that affect them and are involved in decision making. Examples of performance indicators are shown in Table 3-3.

Table 3-3. Indicators of Performance of Water and Green Growth Project

| Managerial | Economic | Environmental | Social |
|---------------------|---------------------|-------------------------|-------------------------|
| Fulfillment of goal | Contribution to GDP | Water quality | Physical well-being |
| Timeliness | Job creation | Freshwater availability | Quality of life |
| Within budget | Balanced growth | Biodiversity | Access to services |
| Appropriateness | Price stability | Disaster safety | Class/gender equity |
| | FDI, net flow | Reforestation | Degree of participation |





CHAPTER 4

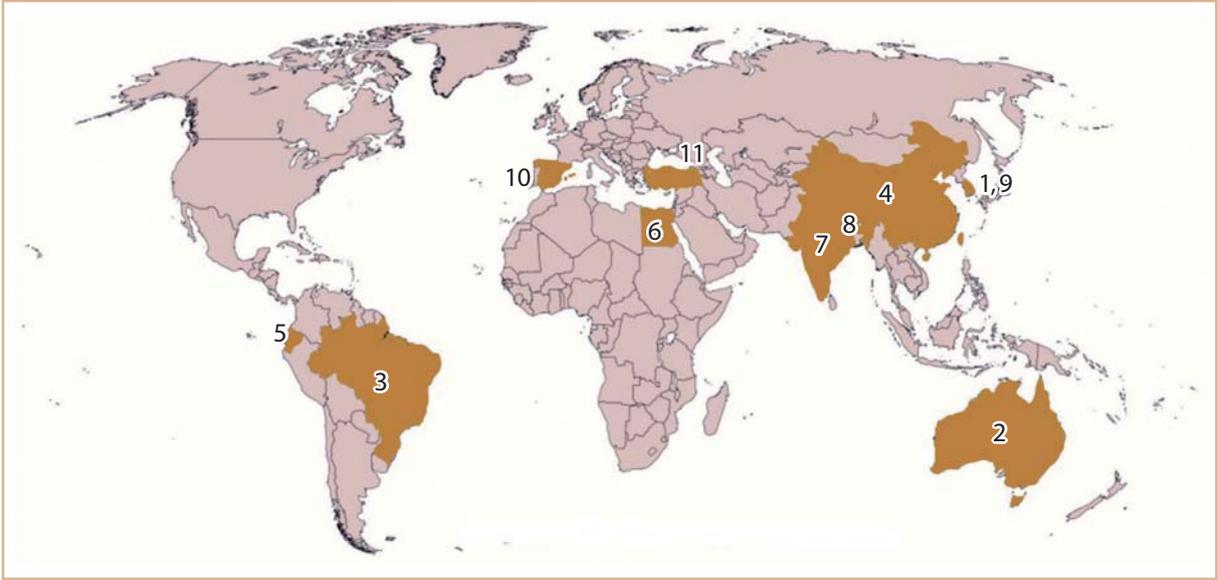
CASE STUDIES AND ANALYSIS

This chapter presents summaries of the 11 case studies and the major findings based on the case study analyses, questionnaires, and interviews. To analyze the relationships among exogenous and endogenous factors, institutions, and performance, strategic, institutional, and evidence-based approaches were used. For each of the 11 case studies at least 20 survey questionnaires were taken from experts and stakeholders, and five project-relevant respondents were interviewed. The analyses delineate which institutions and policy instruments are effective in realizing Water and Green Growth. Based on the results, key messages and policy implications will provide policy makers with suggested policy guideline and policy implementation roadmap to consider adopting in their countries.

4.1. Summary of Case Studies

This section includes a brief summary of the 11 case studies that were studied in-depth for Phases 2 and 3 of the Project, emphasizing the effective institutions and policy instruments based on the case study reports and interviews. As described in the previous section, the case studies were evaluated on the basis of water institutions and policy instruments, divided among state-driven, market-oriented and community-centered institutions. The case studies were also evaluated with performance indicators in economic, environmental, and social dimensions. The examples of indicators that are shown in Table 3-3, and those received the top rating for each case study are presented in the summaries. The most important policy aspects, as perceived by the persons who responded to the questionnaires, are also shown in the summaries below. The results might not always be consistent with the data presented in the full case studies, which were based on broader considerations of exogenous factors and World Bank/United Nations data. However, key messages and policy implications can serve as policy guidance for decision makers who want to apply Water and Green Growth strategy as a national plan, whilst referring to each case’s specific context. These summaries were derived from the full version of the case studies, which can be found in *Volume 2* of the report or in an accompanying memory stick

Summary of the each case study is comprised of four parts which are background and challenges, actions taken, performance, and major findings and policy implications. It is to describe how each project has been initiated, what institutional changes led to successful performance in terms of economic, environmental and social dimensions. Major findings and policy implications are extracted from the case study reports considering endogenous, exogenous factors, institutions, and performance.



Box 4-1. Water and Green Growth Case Studies

1. **Republic of Korea** Lake Sihwa Water Quality Improvement Project
2. **Australia** Murray Darling River Basin: Water Trading and Water Use Efficiency
3. **Brazil** Integrated Water Resources Management: How National Policy and Practices Support Green Growth
4. **China** Shanghai Pudong: Public-Private Partnership
5. **Ecuador** Water Fund Mechanisms for Watershed Protection
6. **Egypt** Desalination for Agricultural Development
7. **India** Water Management in Gujarat State: Mix of Policy and Infrastructure Initiatives Result in Green Growth
8. **Nepal** The Andhikhola Hydrel and Rural Electrification Project
9. **Republic of Korea** Taehwa River Ecological Restoration Project
10. **Spain** Ebro River Basin: Sound Water Planning Supports Green Growth
11. **Turkey** Restoration of an Urban Estuary: Golden Horn, Istanbul

Background and Challenges: Water Pollution

When the Sihwa District was in the period of development, economic growth was the top priority at the national level. From 1985, the government began to reclaim land under a conglomerated plan for industrial sites, satellite cities, and agricultural production. Following the completion of the seawall in 1994, water quality began to rapidly deteriorate due to lack of adequate wastewater flow prevention and treatment facilities, which were unable to handle the increase in population and factories. Two years later, pollution of the area became a national issue as the situation was widely broadcasted on television. In response, the President ordered the Ministry of Environment (MOE) to restore the water quality. In coordination with related agencies, MOE announced plans to invest 44.3 billion won (US \$ 56 million) until 2001 for water quality restoration (Korea Water Resources Corporation, 2005, p.101).

The short-term water quality restoration measures included the installation of oxidation ponds, constructed wetlands, temporary intercepting sewers, and circulation of seawater. Long-term measures included the expansion and building of wastewater treatment plants and intercepting pipes. Later, the plan to develop Sihwa as a freshwater lake was abandoned, and it became a saltwater lake producing clean energy from tidal power plants.

Actions Taken

State-driven: Indicative Plans, Regulations, and Taxes

From the initial stage of the project in 1985 to rise of the lake's pollution as a national issue in 1996 and to an eco-friendly development path, the project was aligned with *the 5-Year Economic and Development Plans*. The government established water quality improvement measures at the national level and managed the whole process of the water quality improvement project (e.g. *the Lake Sihwa Comprehensive Management Plan, 2001* and *the Lake Sihwa Water Quality Improvement Measures, 1996* organized by MOE). The financial burden and responsibilities between the ministries were coordinated, and the central government established the system that could undertake the project

The total amount of each type of pollutant is set and its discharge loads are being managed within quota limits. Firms that exceed such limits could be forced to halt operations, have their facilities closed, or be subject to fines (*Water Quality and Ecosystem Conservation Act*, Chapter 4 Article 7). At national level, a water quality tax is imposed on pollutants discharging buildings and facilities.

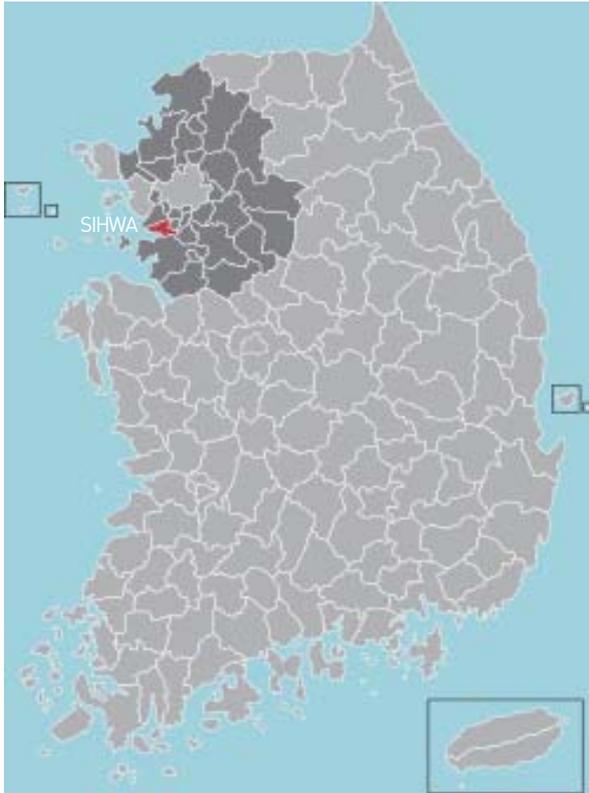
Market-oriented: Cost Recovery and Private Sector Promotion Policy

The profit-cost structure and commercialization were at the base of the project despite the central government and the public actors serving as the lead actors. The reclaimed land and Lake Sihwa use rights were distributed to investors of the seawall in proportion to their investments. Based on these rights, K-water, the executor of the project, aimed to make up for costs of developing land and improving the quality of Lake Sihwa by parceling and selling the land and operating the tidal power plant. Part of the costs were shouldered by the local and central governments through taxes and sewage treatment fee collection.

When plans to develop Sihwa as a freshwater lake were abandoned, institution of water rights also disappeared. Instead, K-water began to recover costs from revenue from electricity generating from the tidal plant. Overall, the cost recovery structure made the improvement of water quality project possible, which required large expenses.

Community-based: Stakeholder Participation and Coordination Mechanism

While the strong political leadership of the central government had a positive impact on comprehensive management plan, there were limitations on the ability to reflect the different interests of local governments and civil society. This limitation was overcome through the formation of the Lake Sihwa Management Committee and Sihwa District Sustainable Development Council (SDSDC), ensuring participation and expansion of local stakeholder representation.



Source: Wikipedia

Figure 4-1. Lake Sihwa Location

The Management Committee is a joint public-private organization for unified decision making and for comprehensive and systematic management of Sihwa. It is comprised of the Vice-Minister of MOMAF as the chairperson, seven other members from the central government, six from local governments, three from related organizations, and four from the civil society organizations. The SDSDC is a decision-making organization comprised of representatives from the central government, local authorities, community residents, experts, and local NGOs. Its co-chairs are elected from the local government and civil society. The SDSDC is

an advanced social consensus system that opens all the results and conclusions to the general public.

Performance

Environmental: Improvement of Water Quality and Increase in Biodiversity

Following the implementation of the Lake Sihwa Water Quality Improvement Measures, water quality drastically improved. The circulation of seawater in and out of the lake, with pollution prevention measures and the maintenance of sewers and treatment facilities, has significantly contributed to its success. In the case of biodiversity, the number of birds and fish significantly increased after the water quality measures were implemented.

Economic: Local Economic Development

With an influx of population and young people into Ansan, Siheung, and Hwaseong (where Banweol and Sihwa Industrial Complexes are located), the number of businesses drastically increased from 3,729 in 1994 to 6,312 in 2009. Not only did it help to revive the local economy and alleviate the dense agglomeration of people and factories in Seoul, but it also increased the regional employment rate.

Social: Improvement in Quality of life and Stakeholder Participation

Local residents' quality of life significantly improved as Lake Sihwa became a place of leisure and ecological learning for the local residents with improved water quality and elimination of bad odor. Also, its institutionalization of stakeholder participation including the public in the decision-making process facilitated consensus building and political support, reducing conflicts around the project.



Source: K-water



Source: K-water

Figure 4-2. Constructing and Connecting the Sihwa District Seawall

Findings and Policy Implications

Social and environmental expenses can be reduced through the pursuit of green growth.

Due to poor environmental planning, development of Lake Sihwa incurred extra social and environmental costs. Public resentment rose in response to the release of fumes, wastewater, and other toxic substances, and tensions among stakeholders were frequent. These expenses could have been avoided for the most part if the development of Sihwa District had been pursued with attention to environmental values from its initial stage. Therefore, Water and Green Growth, which environmental aspect is considered from the initial stage, is a cost-effective strategy in the long term.

Despite changes in the state's role, it remains important.

In the Sihwa District Development and Lake Sihwa Water Quality Improvement Project, the government demonstrated considerable leadership despite the change and increase in its influence due to community-centered governance approach. The state is still playing a large role in the allocation of resources, the generation and distribution of information, the formation of the legal system, and the establishment of plans.

The market's role becomes increasingly influential in cost sharing and configuration of rights.

Investors' water and property rights were recognized. Based on these rights, K-water (the project executor) was able to recover its project construction and implementation costs by selling and parceling lands and operating tidal plants. At the same time, this reduced the financial burden on the local and central government.

Stakeholder participation and coordination mechanism are the key factors to the success of the project.

Community participation is necessary in order to reflect and coordinate diverse values, such as environmental value, community value, social value, and others. Groups benefiting from the economic sector and groups having to shoulder the burden of environmental and social costs of the development could be different, and there were many instances where the benefits and burdens were not evenly distributed. The SDSDC was able to resolve stakeholder conflicts around the project, to include the community in the decision making on water quality improvement

and to set the direction of the Sihwa District Development Project. Stakeholder participation and an effective coordination mechanism can reduce unnecessary political and social costs.

New economic opportunities can be sought through adoption of innovative green technologies.

Adoption of innovative technology such as constructed wetlands and tidal power plants not only improved the water quality of Lake Sihwa, but also provided economic benefits. The wetland area now hosts a research and education center with a steadily increasing number of visitors, helping to stimulate the local economy. The Sihwa Tidal Power Plant caused no additional harm to the environment while producing eco-friendly energy, helping to ease Korea's recent close-to-capacity energy usage. It is also attracting tourists, increasing its regional income.

Well-organized indicative plan is essential.

It is essential to integrate decentralized plans and establish systematic comprehensive plans. It is significant to design policies with priorities while ensuring sustainability of the plans.

The political and social contexts can impact the performance of the project.

Following the Nakdong River Phenol Spill, concerns on water quality and environmental issues among the public rapidly increased. This facilitated the water quality restoration to become a policy priority. The launch of a local autonomy system in 1997 also reinforced the role and authority of local governments and enhanced the influence of local residents in their own decision making. In addition, high tertiary education enrollment at the time and political stability contributed to active participation of residents in political affairs.

Background and Challenges: Water Quality, Sustainability of Irrigation and Allocation

Australia faces severe difficulties on balancing supply and demand for water, triggered by the climate change and an increasing awareness of the environmental costs of water withdrawals. Severe droughts have pushed the government to pay attention to an innovative way to secure adequate access to water resources. In Australia, the Murray-Darling Basin (MDB) is one of the most important areas to provide water sources and agricultural lands. However, it contains a large degree of uncertainties due to the sheer size of territory, diverse water users, high variation of the volume of water, water rights within and between states.

Actions Taken

State-driven: Indicative Plans

In recent years, Australia has witnessed the emergence of a sound institutional framework for water management, i.e. *the National Water Initiative 2004*, *Water Act 2007*, and *Water Amendment Act 2008*. Stakeholders include state governments and MDB organizations that are coordinating at the sub-basin level through river basin management organizations.

The 1994 Commonwealth Government and Council of Australia (COAG) Water Reform Framework was extended by the National Water Initiative of 2004 (NWI). It includes: (1) full cost pricing of water consumption; (2) water resource management at the catchment level; (3) clear water entitlements; and (4) separation of water rights from land ownership.

Market-oriented: Water Rights Trading

Water rights have been institutionalized, which are separated from land rights and can be traded between different water users. The total quantity of water rights have been capped across the entire river basin for the efficient allocation of water rights. Such institutional settings have paved the way for establishment of a solid water market in the river basin.

The introduction of the cap in the MDB by the Commonwealth Government has focused on the efficiency of water use and the trading of water rights to the most valuable user. The volume of water trading has escalated. Water trading has proved to be a useful tool in helping water users, particularly irrigators, to respond to changes over the past decade. The promotion of tradable water rights had been facilitated by *the National Water Initiative in 2004*, which aimed to ensure efficient administration of water trading and numerous programs to stimulate inter- and intra-state trading.

Community-centered: Stakeholder Participation and Coordination Mechanism

The basin is sustained by a complicated arrangement of horizontal and vertical institutions that bring together and represent stakeholders across different states, sectors, and diverse ministerial departments. The COAG has consolidated mutual cooperation at the river basin level. The Basin Community Committee (BCC) represents community interests, and acts as a channel for the community and a conduit for collection of information from the Murray-Darling Basin Ministerial Council (MDBMC). The MDBMC



Source: Murray-Darling Basin Authority (<http://www.mdba.gov.au/>)

Figure 4-3. Murray-Darling River Basin

can make decisions at the river basin level, which requires unanimity among the river basin states. The Murray-Darling Basin Authority (MDBA), which is the executive arm of the MDBMC, facilitates cooperation between states and stakeholders and oversees various working groups on river basin sustainability and water supply.

The Basin Authority works with indigenous groups on cultural heritage projects, training and capacity building programs, and environmental works and measures projects in the southern Basin (e.g the Lake Victoria Cultural Heritage Program and The Living Murray Indigenous Partnerships Program).

Performance

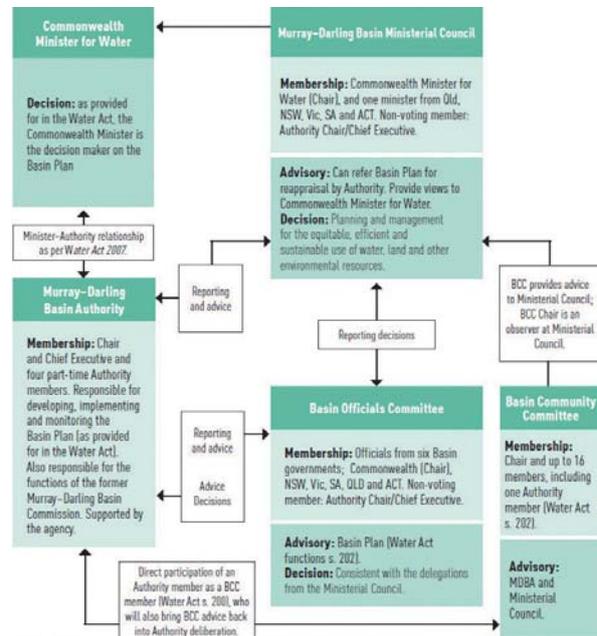
Economic: Technological Advancement

According to respondents, the water trading system did not contribute to economic performance. In particular, water trading has had a negative impact on GRDP and job creation.

Environment: Increased Environmental Awareness

On the overall performance, environmental awareness was seen to have the greatest impact. Under the National Water

Initiative drive, policy reforms consolidated the river basin approach, and sub-basin organizations have subsequently emerged. As a result of training and capacity building programs at basin level, environmental awareness has increased.



Source: Murray-Darling Basin Authority (<http://www.mdba.gov.au/>)

Figure 4-5. Structure of the MDBA



Source: Murray-Darling Basin Authority (<http://www.mdba.gov.au/>)

Figure 4-4. Interstate Water Trading Zones

Social: Citizen Participation

In the social performance sector, citizen participation emphasizes community involvement in decision making in the river basin. The Community Advisory Committee (CAC) and the MDBA facilitate stakeholder participation in policy design and implementation.

Findings and Policy Implications

The clear legal framework paves the way for implementing policy.

The establishment of water rights in the legal and institutional framework paves the way for efficient allocation of water. *The National Water Initiative* that was enacted in 2004 regulated water entitlements, ensured connectivity between surface and groundwater and removed barriers to trading water rights. The clear legal framework was also strengthened by institutional arrangements that improved the enabling environment for coordination at basin level.

The balance in relevant government layers and stakeholders at basin level led to enabling conditions for water trading.

The Murray Darling Basin demonstrates a case where a wide range of stakeholders are included. The complicated arrangement of horizontal and vertical institutions in the basin brings together representative stakeholders across different federal states, across sectors, and across different ministerial departments. The successes of the management of the MDB are attributed to the institutional arrangements.

Expenditures on research and development (R&D) guarantee sustainable growth

The total amount of R&D investment had increased from 1.56% in 2000 to 2.37% of GDP in 2008. Technical factors have been more influential than social or economic exogenous factors. For instance, irrigation technology has enhanced water efficiency, and information technology has facilitated the water-trading process. Water traders are able to make better decisions based on information technology, making the allocation of water more efficient.

Favorable political environment is a prerequisite for implementing effective policy making and implementation.

Australia has the lowest perceived levels of corruption among 11 case studies scoring 81 out of 100 in 2013. They are ranked as the highest in the world for political stability according to Economist's Political Instability Index. The favorable political environment has contributed to project's success and supported autonomy of the state government.

Climate change impacts should be taken into account for water resources management in the coming decades.

Severe disasters such as prolonged droughts can induce policy shifts for sustainable water consumption. The four-year drought that began in 1979 triggered agricultural and job losses in rural areas. Since then, water resource management has drawn more attention from the public as a salient issue to be dealt with. In response to increasing uncertainties of climate change, adaptation policy is required.

Ensure water supply is important for socio-economic development.

Australians consume about 290 liters of water per person per day. This varies significantly across the country from 493l/day in Western Australia to 221l/day in Victoria. There were concerns raised about the efficiency of agricultural water use. The soaring demand of agricultural water and unpredictable rainfall have driven the creation of river basin institutions and policies in the MDB. Water allocation is the key issue to be addressed in Australia. Urban demand for water has soared, and the growth of agricultural demand of water has also increased in order to provide sufficient amount of water for food. Therefore, adequate supply of water for urban and agricultural areas has been crucial in setting up water resources management plans and policies.

Background and Challenges: Deforestation, Water and Sanitation, and Water Supply

Deforestation has been a major issue in the last 30 years, causing river sedimentation and reductions in the base flows during the dry season. The high erosion rates have contributed to the impairment of water supply sources, to the silting of reservoirs, reservoir volume losses and additional costs of water treatment.

The north part of Brazil has suffered from overexploitation of its mineral and forest resources and poorly planned development. The Northeast where the 30% of the country's population lives along the coast, suffers from chronic droughts and water shortages for agriculture and domestic use. The water pollution in the Southeast of the country is one of the major concerns; the low share of collected wastewater that is being treated (30-35% in 2012); and long-standing tensions between the federal, state, and municipal governments about their respective roles in the sector.

Despite the significant economic development of Brazil in recent decades, many remote regions of interior and urban *favelas* still suffer from water and sanitation services deficit. The high proportion of poor Brazilians living in urban slums (*favelas*) and in rural areas are without access to piped water supply and adequate sanitation services.

Actions Taken

State-driven: Indicative Plans

In the past, a centralized and rigid system dominated water resources management. This situation changed after the adoption of the 1988 Constitution, *the National Water Policy Law*, and other important legal instruments. *The Brazilian Water Law* stipulates the establishment of a series of institutions and agencies including the National Water Agency (ANA) that is in charge of overall water resources management, and the National Council of Water Resources (CNRH), responsible for the establishment of the national water policy. In addition, the National Water Resources Management System (SINGREH)

is responsible for planning, regulating and controlling the use, preservation, and the reclamation of water resources.

Five management instruments were created to help with implementation of national policy, as follows: river basin plans, classification of water bodies, water permits, water use charges, and information systems (The Brazilian Water Law).



Source: Felipe Menengaz, Mapa Clicável do Brasil (Brazil State Map), Wikimedia Commons

Figure 4-6. Map of Brazil Showing 26 States, the Federal District and Five Regions

Market-oriented: Public-Private Partnerships, Water Tariffs, Payment for Ecosystem Services

Market-oriented instruments and institutions are still in the beginning stages in Brazil. However, with the *Public-Private Partnership (PPP) Bill* (Law no. 11079) in 2004, this reality is slowly changing. It is expected that with continuing PPPs the sanitation deficit in Brazil will be considerably reduced. Also, the use of water and sewerage tariffs and financial instruments by river basin committees such as the Paraíba do Sul and the Piracicaba, Capivari, and Jundiaí River Basins (PCJ) are promoting water-use efficiency and pollution abatement. Water users are charged based on their consumptive use and sewage by released volumes and BOD abatement level. Such arrangements are expected to spur investment in water consumption reducing and sewage

treating technologies in the long run. However, these market-oriented instruments have only been effective in a few developed basins, with existing water-use conflicts and participating users and stakeholders.

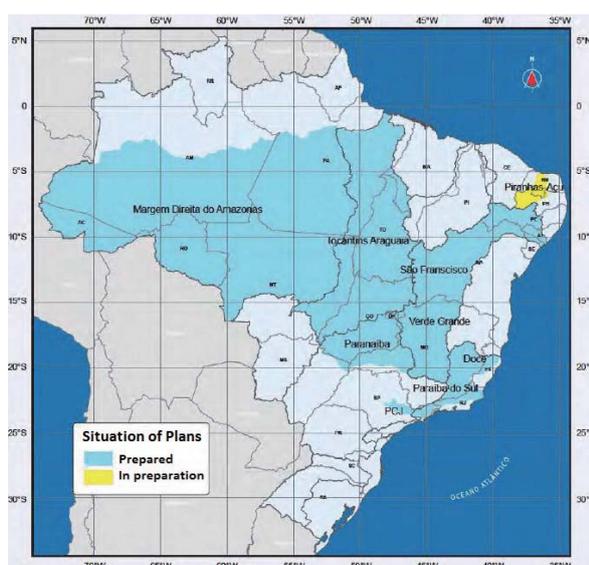
The implementation of payment for ecosystem services (PES) can effectively reduce runoff and increase groundwater recharge to tackle climate variability and related threats by encouraging farmers and other stakeholders to adopt best management practices (BPMs) that promote infiltration and groundwater recharge, and augmentation of base flow during the dry season. Also, it provides incentives for abatement of pollution point sources by engaging municipalities to participate in solving their own pollution problems through specially designed sewage treatment projects. Brazil has designed and implemented water-oriented PES programs such as the Basin Pollution Control Program (PRODES) and the Water Provider Program (WPP).

PRODES provides financial incentives for the construction of sewage treatment facilities based on their BOD abatement performance. In PRODES, ANA co-finances the sewage treatment plants built by states and municipalities, only for completed and operating plants. Such performance-based and product-oriented approach contributed to increase in the efficiency of sewage treatment in river basin and avoided the risks of non-completion of federally-funded sanitation works which was common practice.

To tackle reduced agricultural yields from high erosion and sedimentation rates that impair water supply sources, ANA developed a program that would financially compensate participant farmers for effective erosion and sedimentation abatement. The rationale behind the program is that erosion obtained from BPMs in farms would provide a similar reduction in sedimentation downstream, which would benefit water users and the aquatic ecosystem with payments preferentially made by downstream water users and/or local governments.

Community-centered: Stakeholder Participation

In addition to the government and basin-level authorities, local and non-governmental actors also participate in water governance in Brazil. For one, water associations formed by municipalities and companies named inter-municipal consortia are aimed at reclamation of water resources and the capacity building of basin stakeholders to be integrated into basin management. Also, water user association such as the Association of Farmers and Irrigators of Western Bahia (AIBA) aims to build technical capacity of farmers and mitigate conflicts in water-use conflict prone regions. There are two active NGOs, the Nature Conservancy (TNC) and World Wildlife Fund (WWF) that support national and regional water programs in terms of technical and implementation capacity. Such initiatives are important for local stakeholders such as farmers and small water users to perceive the importance of IWRM and their role in water management, contributing to local green growth.



Source: ANA (2009)



Source: ANA (2013)

Figure 4-7. Situation of the Federal River Basin (Left); Picarrao Sewage Treatment Plant (Campinas-SP), Financed by PRODES (Right)

Performance

Economic: Technological Advancement

Technological advancement has helped the economic sector significantly. New technologies, such as drip irrigation and irrigation based on crop requirements, have contributed to reducing high water demands of the past.

Environment: Increased Environmental Awareness

Payment for ecosystem services (PES) has been effective in improving environmental performance. In particular, the Water Provider Program has resulted in raising awareness of ecosystem services and enhancing human capacity by providing training courses related to best management practices (BMPs). In addition, more than 7 million people in six states have benefited from improved water quality from the Basin Pollution Control Program (PRODES) projects. The program has also succeeded in enhancing health and regional green growth.

Social: Improved Quality of Life

Brazil experienced very rapid economic growth since 2004, which resulted in serious environmental deterioration. Over the same period, however, social indicators such as life expectancy and education enrollment, improved significantly. Part of the improvement is attributed to better water resources management, enabling access to water. The abundant water resources in Brazil and its attention to water management in the last 25 years contributed to growth and an improved quality of life.

Findings and Policy Implications

A clear legal framework supports implementation of the national policy.

The Brazilian Water Law has established five management instruments to help the implementation of national policy: river basin plans, classification of water bodies, water permits, water use charges and information systems. The law also mandates that all municipalities and states prepare a sanitation plan and empowers local stakeholders to participate in water resources management. A clear legal framework can make a strong contribution to the implementation of water policy.

Continuous capacity building of water users and stakeholders is required, especially in the water and environmental management.

Water users and various stakeholders are invited to be involved in water resources management. With promulgation of the *Water Law*, basin committees have been established, which comprise different levels of government and water users. The representative committee is the Piracicaba, Capivari, and Jundiaí River Basins (PCJ) committee. It has 50 members, representing the federal and local governments, water users, stakeholders and NGOs. The PCJ committee has embarked on several activities, including hydrologic monitoring, basin conservation, water quality improvement, and capacity building. The basin committees enable national policy to be activated based on stakeholder participation.

Economic instruments can fuel the implementation of green growth.

Payment for ecosystem services (PES) give incentives to water users to protect and enhance ecosystem or environmental services. These payments can have direct and indirect advantages to ecosystems. They can increase the efficiency of managing lands and can change the polluters' behaviors by charging taxes to polluters. In addition, such payments can be a source of financing for developing and developed countries.

Environmental education could be effective in the promotion of green growth.

In particular, the Water Provider Program (WPP) resulted in raising awareness of ecosystem services and enhancing human capacity by providing training courses related to best management practices (BMPs). In addition, water quality has been improved by the PRODES program which values ecosystem services and provides support to construction of sewage treatment facilities. Wastewater treatment became a legal obligation of every municipality in Brazil, and sewage treatment plants must meet legal compliance requirements.

Background and Challenges: Water Shortage and Water Quality

The central government aimed to establish Shanghai as one of the world's leading financial and economic centers, while making Pudong a modern showcase for the ongoing economic reform that created the Special Economic Zone. The rapid economic development, population growth, and urbanization of Shanghai in the period between 2000 and 2010 had resulted in worsening water quality and pollution-induced water shortages.

The untreated domestic and industrial wastewater, frequent flooding, and street runoff all contributed to the water quality deterioration around Shanghai. Also, natural disasters restrict economic and social development, posing serious threats to life and property.

Such factors prompted the municipal government to adopt an innovative approach, and one of the most feasible options was to invite private sector to participate in managing the water sector. Private sector players were expected to bring in their expertise in the Shanghai's water sector, such as financing, management, know-how, and cutting-edge technologies. The municipal government devoted itself to reforming its legal and administrative systems, providing an enabling environment to foreign investors.

Actions Taken

State-driven: Indicative Plans, Water Tariffs, and Regulations

Following the central government's attempt to make Shanghai one of the world's leading financial and economic hubs from mid-1980s to 1990s, it was necessary to provide adequate water services to the Pudong New Development Area not only for the general public but also foreign investors in order to invite more foreign direct investment (FDI). Considering several options on how to improve water services, both central and local governments in China decided to invite private companies to bring in more investment, cutting-edge technologies and advanced management skills for urban water services.



Source: Migues (2008)

Figure 4-8. Shanghai Pudong Location

One of the government initiatives for implementing Public Private Partnership (PPP) projects was the 21st century Urban Water Management Pilot Scheme (1997) that aimed to increase water tariffs for favorable rates of return for the water project in which foreign investment was involved. This scheme provided a good enabling environment for foreign investors.

Although PPP projects in the water sector were strongly encouraged, decisions on water tariffs in urban water supply remained with the government under *the Price Law*. A water supply company has responsibility to submit water tariff plans to local price authorities for permission to raise rates.

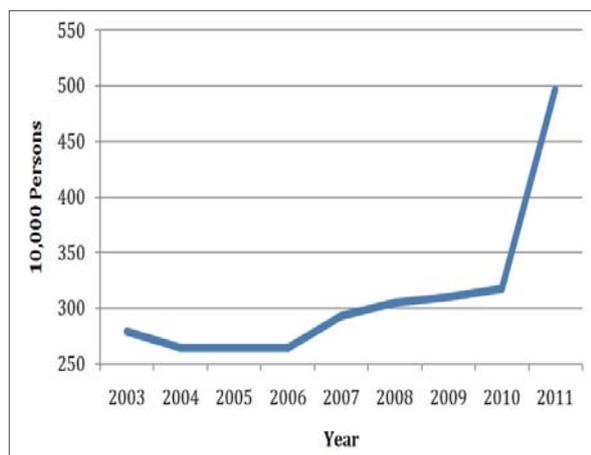
An adequate level of laws and regulations facilitates private companies' investment in water services. With regard to China, these institutions have strengthened the law enforcement of environmental regulatory agencies, such as the Ministry of Environmental Protection with the discharge permit for waste water and total pollution control. Such reinforcement of pollution prevention measures can drive governments to put more investment in urban wastewater services, which provides more business opportunities to wastewater service companies.

Market-oriented: Private Sector Promotion Policy

From 1950 to the early 1980s, the government emphasized universal access to water, but the involvement of the private sector in the water sector was negligible. These circumstances had caused an overall inefficiency of water services, dilapidated facilities, poor management of water services, and lack of funding. The Shanghai municipal government had difficulty in addressing the problems properly.

In the 1990s, there was a policy change and both central and local governments decided to involve private sector companies (in order to attract investment, technology transfer and management skills). Private sector participation can come under the following categories: commercialization of public utilities, management contract, lease contract, Greenfield Contract, concession contract, joint venture, and full sale.

The Shanghai Municipal Government is part of the Shanghai Pudong joint venture via the Shanghai Chengtou Group, an infrastructure development, operations and investment group owned by the municipal government. Veolia Water was awarded the contract in 2002 and agreed to invest about US\$ 240 million for the purchase of a 50% stake in the Shanghai Pudong Water Corporation for 50 years. Shanghai Pudong Veolia Water Corporation Limited (SPWVC) became China's first public-private partnership for the management of drinking water services. The objective of the project is to meet the need of the growing population to have adequate access to good quality of water in Shanghai.



Source: National Bureau of Statistics of China

Community-centered: Stakeholder Participation

The Shanghai Pudong joint venture has had an active role with the community via forms of education, research cooperation, and funds and innovation awards to increase overall awareness on the environment. Also, the corporation has an obligation to organize a formal public hearing during the water tariff setting process.

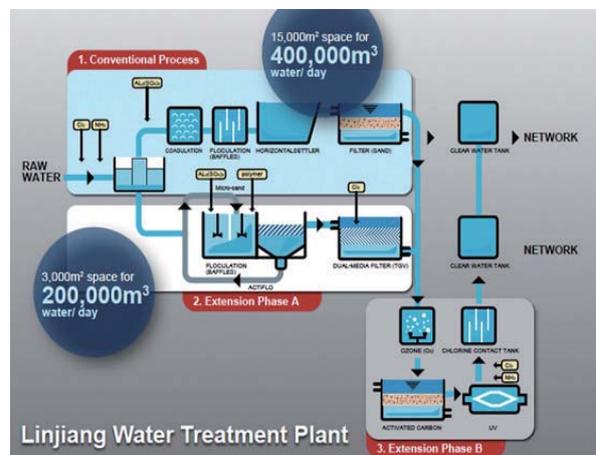
Performance

Economic: Technological Advancement

China's research intensity has tripled since 1998, whereas Europe's has barely increased. Technological advancement is a key achievement of the joint venture in terms of reducing costs and wastage of water. A brand new customer service management system was installed, connected with optimized meter-reading with PDAs and GPS localization. Bringing smart technology to network management (GIS, SCADA, Hydraulic Model, traceability, PDA for network maintenance) contributes to efficient water resources management. This technological advancement and transfer is attributed to private sector involvement.

Environment: Improved Water Quality

The water quality improvement has the highest rating for environmental performance. Before the project, it was difficult to use the tap water, but its use for drinking purpose is now satisfactory. The construction of the Deep Water Treatment Plant produced good water quality that meets the national, European and USA quality standards. In particular, substances including manganese have been removed, which significantly improved the taste and odor of tap water in Pudong.



Source: SPWVC (2012)

Figure 4-9. Number of Employed Persons in Shanghai (2003-2011) (Left); Linjiang Water Treatment Plant (Right)

Social: Improved Quality of Life

The quality of life of Pudong residents improved due to better access to basic services and quality of water. With the development of Pudong Area, the city of Shanghai was committed to ensuring safe water supply and at all times and to providing adequate water supply solutions.

Findings and Policy Implications

The strong leadership of the state played a central role in implementing policy.

With the well-organized plans of Chinese government that drove rapid growth in Shanghai in recent years, the central government promoted private sector participation in collaboration with the Shanghai municipal government. Private sector involvement in the water sector can enhance the efficiency of operation and improve quality of services.

Stable government leads to a favorable business environment for investment.

Private sector involvement in financing for the water sector is a feasible option for the government to overcome financial constraints. It is important for the government to provide a good institutional framework for the water business with which the government can effectively regulate business activities of private players. In addition, such settings pave the way for private players to conduct business without being wary of unexpected market risks.

Coordination between the local and central government improves decision making.

The case of the Shanghai Pudong project indicates that decisions on water tariff levels in Chinese urban areas can be made by local governments in accordance with the guidelines imposed by the central government in Beijing. Local governments carefully have a look at a water tariff increase plan proposed by water companies. Prior to any decision on water tariffs in localities, public hearings should be undertaken in order to reflect views and opinions from the general public and other end-users. The balance between water-related ministries and different level of governance layers is important.

Adopting high-tech technology improves water quality.

The Shanghai Pudong water PPP project has contributed to enhancement of water quality in the city through establishment of an independent laboratory and regular monitoring activities. High-tech technologies have been adopted, including the real-time monitoring devices, and the Linjing water Treatment Plant and the Jinhai Water Treatment Plant have employed state-of-art technologies in order to improve water quality, allowing them to provide good quality of water to over 70 million visitors during the 2010 World Expo.

The integrated water management must include disaster safety improvement.

Disaster safety improvements received the lowest environmental performance rating in the Shanghai case. As China is frequently affected by natural disasters, more than 200 million people suffer the negative impacts every year. Natural disasters are an important restricting factor for economic and social development, and they pose serious threats to life and property safety in China. Since national security and social stability are affected by China's natural disasters, relevant measures should be taken in order to prevent damages from water-related disasters.

Background and Challenges: Unevenly Distributed and Contaminated Water

Ecuador is a country with relatively abundant water resources, four times more than the world average per capita. The challenge is uneven distribution and contamination of water resources in the country. Many of the big industries such as banana plantations pay small fees for water use, monopolize water resources, and ignore existing laws. Small and large-scale metal mining is also a problem, which can cause disastrous impacts on the environment. The mining requires toxic chemicals, such as mercury and cyanide. The chemicals contaminate the entire biosphere of water, land, and air, and can kill animals and pose a health hazard to miners and nearby villagers.

To solve the problems, the Ecuador Water Funds programs were established as innovative funding mechanisms. The water funds are endowment trusts and based on payment for environmental services (PES) principles. The funds support environmental protection in watershed areas over the long-term and provide support to local communities in rural areas who participate in water management. Ecuador has so far developed five water funds in different municipal areas. The case focuses on the Water Protection Fund (FONAG, el Fondo para la Protección del Agua) in Quito, the capital of the country.

Actions Taken

Market-oriented: Private Sector Promotion Policy and Cost Recovery

FONAG was the first case of a water fund in Ecuador, having been established in 2000 by the Quito Metropolitan Area Water and Sewerage Company and the Nature Conservancy. Starting in 2006, FONAG has received 2% of the revenues from the municipal water company to protect the watershed areas that supply water to Quito's residents. Revenues from the municipal water company are invested in watershed conservation, to improve or

maintain water-related benefits and regulate water-related risks. A portion of the revenue is allocated to create a reserve fund that is geared towards covering some operational costs, and to pay for transactional costs associated with conservation agreements with the communities that live in or near the watersheds. It can cover the costs for operation and maintenance sustainably.

FONAG also includes among its constituents the Tesalia water bottling company, and has also received funding for specific actions from other private companies such as Coca Cola. This indicates a sense of corporate social responsibility in protecting the watershed and the water source by beverage companies.

Water funds promote partnerships between the public and private sectors, involving them in all stages, from design to implementation. In some cases private corporations have been constituents of water funds since their creation, while in other cases, companies have made specific contributions support the implementation of activities of the fund.



Source: Coronel, Lorena and Zavala, P. (2014). Guía y Herramienta Práctica Para Crear Un Fondo De Agua (publication pending).

Figure 4-10. Location of Water Fund Watershed Areas in Ecuador

Community-centered: Stakeholder Participation and Coordination Mechanism

The projects of FONAG include as many stakeholders as possible in protecting the watershed, particularly the end users, such as public water utilities, major public hydroelectric facilities, irrigation systems, agricultural associations, and private companies. Water Funds give an incentive for private business and non-state stakeholders to encourage them to participate. In addition, the communities that have been badly affected by poor water resources management have been encouraged to participate in decision making. Through FONAG's outreach efforts, farmers are taught how to improve their grazing methods and other agricultural practices. They receive training in crop and cattle rotation to prevent overgrazing. Technical teams hold workshops with indigenous farmers and ranchers.

The FONAG is designed to guarantee sufficient and good quality water through co-financing actions aimed at helping watersheds to achieve the natural regeneration of water. The Board of Trustees is the superior body where the decision-making process takes place. The board is made up of representatives from all the member institutions. The Technical Secretariat is in charge of executing the operational activities, developing work plans, regulations, and conservation initiatives for the protection of watersheds and water through its programs and projects.



Photo: The Nature Conservancy

Performance

Economic: Job Creation, and Increased Gross Regional Domestic Product (GRDP)

In Ecuador, the water trust funds that were created with the introduction of FONAG in early 2000 have been considered effective in reaching water users such as city dwellers, farmers, or electricity consumers. As a result of the successful water management in the area, Gross Regional Domestic Product (GRDP) was increased and jobs in the local economy were created. Overall, local development improved.

Environmental: Increased Environmental Awareness

The outreach efforts of FONAG and the importance of environmental sustainability have been emphasized. Through education and training programs, farmers, and indigenous communities came to participate in protecting watersheds.

Social: Gender Equality and Citizen Participation

The water funds mechanisms have become the means to manage water resources and protect the environment in major river basins. The funds have also become a means to drawing contributions from the private sector and public stakeholders. In order for them to work, the communities most affected by deficiencies in water management or water quality must be involved. Farmers, indigenous communities, and landowners were responsible for protecting the land and the quality of the water source, and thus they became involved in developing community watershed policies. Water Funds are a first step to



Photo: Jaime Umaquinga, FONAG

Figure 4-11. Children Participating in the FONAG Conservation Program (Left); Quito Watershed in Protected Area (Right)

providing such an incentive. Indigenous communities, particularly women, need to be consulted and trained in how to best protect the watershed and how the funds can best be used.

Findings and Policy Implications

Indicative plans and a clear legal framework contribute to implementing policy.

Many obstacles have been identified due to the lack of a national-level policy, and a number of policies and institutions overlap. Difficulties in implementing the central government's decisions at the local and the regional levels have created tensions between ministries with conflicting interests at a sub-national level. The National Water Secretariat had difficulties reorganizing and restructuring the institutional framework for water at the initial stage. Indicative plans and a legal framework to support policies are needed as a foundation to implement water policy with consistency.

Economic instruments change the consuming behavior.

Water Funds based on the payment for environmental services (PES) principles have been effective in Ecuador as a means to protect a healthy habitat from which environmental services are derived. Payment for water can be used as an economic instrument to raise awareness for people on the importance of protecting ecosystems and sustainable water resources. Water Funds serve as a trust fund that is permanently capitalized by public and private stakeholders to finance upstream land and water management in order to guarantee clean water supply and conservation initiatives. To improve the effectiveness of PES programs, concrete design, planning and adaptation strategies are essential.

Private sector participation can lead to effective operation and maintenance.

Since as much as 80% of Quito's drinking water comes from two watershed areas (Antisana and Cayambe-Coca), raising public awareness for water fund initiatives became an important factor in those locations. Changes in attitudes and awareness about conservation practices have been evident among people in those areas. Water funds projects contributed to a greater number of rare species and aquatic species, along with improvements in water quality.

Water Funds represent an incentive for private business and public stakeholders. For the water trust funds to work, the communities most affected by deficiencies in water management or quality must be involved. Farmers, indigenous communities and landowners upstream are most responsible for protecting the land and its water quality.

Sustainable financing will be the basic foundation for green growth.

While green growth will create opportunities for job creation and green technology, private investment needs to be encouraged to ensure sustainable financing. Water funds can be a good example to earn revenues to protect ecosystem services sustainably.

Involving stakeholders in the decision-making process can delay the project.

Involving a variety of stakeholders will contribute to capacity building of local residents. Local level stakeholders can participate in the decision-making process directly and indirectly, especially those who are trained in water management. While the involvement of too many stakeholders in decision-making can delay the process of enacting laws or implementing policy, the buy-in by local participants into the resulting policies and institutions will improve implementation in the long run.

Background and Challenges: Water Scarcity

Egypt is located on its northern coast along the Mediterranean Sea, a semi-arid to arid region, where rainfall is a rare weather phenomenon, especially in Cairo, Egypt's capital city. Only 2.8% of the country's total land area is arable. Water scarcity is one of the major environmental issues in Egypt. Egypt has reached the water poverty limit and is categorized as a water-scarce country. Even though the River Nile is the main source of water, the share from the Nile is fixed by the 1959 agreement with Sudan. An excessive use of groundwater for irrigation projects accelerates groundwater shortage.

The pilot site of the project is located in West of Cairo at the Alexandria Desert Road Egypt. The project began operating in 2013 and is producing up to 1000m³/day of water for irrigation.

Actions Taken

State-driven: Indicative Plans, Technology Promotion Policy

The Egyptian government plays a central role as both the originator and decider of key policies in relation to irrigation through the Ministry of Water and Irrigation of Egypt (MWRI). The MWRI is responsible of the development, distribution and management of water resources, and for the organization and maintenance of the related water works. In 2005, the MWRI launched a *National Water Resources Plan* for Egypt (NWRP). This describes how Egypt will protect its water resources in terms of quantity and quality, and how it will use these resources in the best way from a socio-economic and environmental point of view.

The government also initiated the *Integrated Water Resources Plan* (IWRP) 2017 with an emphasis on water supply. The IWRP



Source: Final Agenda, Regional Workshop on Use of Brackish Water for Agricultural Production in the Near East and North Africa: Status, Good Agricultural Practices and New Developments (2013)

Figure 4-12. Site Location

2017 has introduced desalination technology as a means to augment water resources and includes a strategy to expand an amount of marginal-quality water from 10% in 2000 to 17% in 2017. Simultaneously, the *Desalination Roadmap 2030* was developed to ensure a sufficient amount of water supply to irrigation systems. It outlined how different desalination technologies can contribute to meet water resources needs and other objectives.

The Zero Liquid Discharge Technology is used in the project to convert the liquid into dry solid by evaporating. The Egyptian government implemented a technology policy to tackle the water-related challenges and to secure freshwater. The government expanded expenditure in R&D to implement *IWRP 2017* with innovative technology. These processes are energy-intensive and thus expensive but appropriate in cases where other methods cannot be applied due to the existence of groundwater aquifers or the existence of surface water in the vicinity.

Market-based: Private Sector Promotion Policy

Egypt encourages both the public sector and the private sector to apply modern desalination technologies. The application of modern desalination technologies started with distillation followed by electro dialysis (ED) and ending with the use of reverse osmosis (RO). The Ministry of Water Resources and Irrigation encouraged the involvement of the private sector in irrigation activities and the decentralization of decision-making processes. The project has been financed 100% with private funds. Even though the military leadership was not favorable to private sector participation, private investors financed R&D expenditures. Integrated Water Resources Management (IWRM) policy was propelled by the involvement of the private sector in irrigation activities and by the decentralization of decision-making processes.

Performance

Economic: Increased Gross Regional Domestic Product (GRDP) and Technological Advancement

This project contributed to positive economic outcomes, especially in terms of the growth of the GRDP and technological advancement. Better access to water for irrigation will increase the agricultural productivity and output, as well as employment. Local laborers have been employed and related economic activities have benefited.

Environmental: Water Quality Improvement

The project aims to improve water quality. Zero Liquid Discharge Technologies are used to remove salts, minerals, and other materials from brackish water or seawater. This will minimize negative environmental impacts and improve water quality. In addition, this project is being implemented far from densely populated regions, reducing the impacts from noise and other externalities.

Social: Improved Quality of Life

The respondents to the questionnaires indicated that an improved quality of life has the highest rating for social performance. There are successful applications that reusing brackish water in agriculture can be helpful for creating new communities, such as the El-Salam Project that mixes agricultural drainage water with Nile water. This project is expected to create new communities that will decrease pressure on densely populated areas along the Nile and can link the Sinai with the Nile Delta.

Findings and Policy Implications

Political leadership is essential towards the implementation of national technological policies.

The government is committed to investing in R&D in the long term. This policy direction may not be able to produce a series of technologies that are commercially available in the short term. Nevertheless, it is the government that should establish a long-term plan to develop technologies tailored and suitable for its country through substantial funding and institutional support. The top-down approach to implement indicative plans and adopt innovative technologies has proven to be effective.

In response to increasing water demands, investment in innovative technology is necessary.

Population growth and concentration in certain areas were impetus to make the government consider innovative approaches, including advanced technology, such as desalination plants, to provide more water to the agricultural, industrial, and domestic sectors. Better access to water resources through desalination plants for irrigation can increase agricultural production, output, and employment. In particular, it is important to consider environmental protection and economic growth in designing environmentally friendly technology. Preconditions for introduction of desalination technologies were to avoid adverse environmental impacts and to reduce the cost of production in the future.

Stakeholder participation can be effective from the initial stage of policy decision making.

To implement more effective policies, the involvement of the local community from the initial stage of operation of a project is recommended. In the long run, stakeholder participation can provide momentum to implement and support policy. To guarantee concrete results that meet the needs of diverse stakeholders in society and lead to effective policy implementation, the local community must be involved from the initial stage.

Developing countries that are vulnerable to climate change need adaptation policies.

There will be more water scarce regions in the coming decades in Egypt, accelerated by climate change. Climate change adaptation policies should be considered in relation to Water and Green Growth projects. Egypt has already reached the water

poverty limit and now it has been categorized as a water-scarce country. As 82.6% of water available from the total amount is used in agricultural activities, the Egyptian government should ensure that adequate water resources are available. More international support and cooperation are necessary in the future. Approaches to climate change adaptation will also be needed by other developing countries that lack of adaptive capacity.

Background and Challenges: Water Shortage and Water Quality

The state of Gujarat is one of the most water scarce regions in India. Up to 80% of the total territory houses a renewable water resource endowment of less than 1,000 m³ per capita per annum, with two-thirds of the state prone to frequent droughts. This situation is attributed not only to a lack of rainfall and limited amount of surface water, but also to an overexploitation of groundwater resources. In this case, the regions with a poor water endowment have unsustainably high water demands primarily due to agricultural use in arid regions and the rural population's high dependence on water for livelihoods. Also, many areas suffer from serious water quality problems due to excessive fluoride, nitrate, and salinity from saline intrusion of coastal seas. This created health problems, making access to good quality drinking water one of the States' top priorities.

However, Gujarat has experienced significant economic growth in the last 15 years due to improved technology in agriculture, the manufacturing sector, and skills and infrastructure development. Its water security needs were met through inter-basin transfers. This was achieved via large water infrastructure projects: Sardar Sarovar Project (SSP); the transfer of water for recharge of depleted alluvial aquifers in north Gujarat; large-

scale promotion of drip and sprinkler irrigation systems; the Sabarmati Riverfront Development Project; and large-scale decentralized water harvesting. In addition to large investments in water infrastructure, the success is partly attributed to modifications in water and energy policies and changes in water administration. The stable government and its determination to solve its water quantity and quality problems, along with rapid economic achievements and human capacity development, contributed to Gujarat's success.

Actions Taken

State-driven: Subsidies and Technology Promotion Policy

Although India lacks an umbrella framework to oversee freshwater in all its uses, its administrative directions (although not a legislative instrument) have been extremely influential as a form of intervention, especially for rural drinking supply. Plus, central changes in the policy framework were quickly adopted at the State level.

Over the past 15 years, the State has responded to water shortage that constrain economic and social development through a package of institutional and technological programs: creation of a state-wide water grid; small water harvesting for irrigation; inter-basin transfers of water from the Narmada River Basin; and power sector reforms. It is significant that state-driven institutions have been the most influential on water sector reform in the State of Gujarat. Such multi-faceted efforts were almost entirely made by the public sector with enormous public investments.

In 2001, the State adopted a strategy to extend the water grid for bulk water transfers from sustainable surface water resources to areas with shortages. A huge investment was undertaken in large-scale infrastructures including bulk pipelines, distribution pipelines and water filtration, and treatment plants, which carried out by the Gujarat Water Supply and Sewerage Board (GWSSB) to solve drinking water distribution and poor water quality issues.



Source: Wikimapia <http://wikimapia.org/country/India/Gujarat/>

Figure 4-13. Map of Gujarat and Location in India

The Gujarat Green Revolution Company (GGRC) is an agency set up by state government as the Special Purpose Vehicle (SPV) to promote efficient irrigation technologies in Gujarat. The GGRC had made it easy for the farmers to purchase a micro irrigation (MI) system, mainly using drip or sprinkler irrigation, with state subsidies. To avail the government subsidy, first the surveyor needs to survey the farm and prepare the estimates. Then, the farmer makes an application to the GGRC, along with the 50% payment of the total cost. Afterwards, a tripartite agreement is signed among the farmer, MI Company, and the GGRC. Upon the certification, 90% of the cost is released to the company, and 10% of the system cost is retained with GGRC that would be released after five years. This is to make sure that the farmer uses the system properly and after service is provided by the company.

Market-oriented: Private Sector Promotion Policy and Tariffs and User Fees

Although most of the reforms in the water sector are taken by the public sector, private sector participation is promoted to some extent. In a form of public-private partnership, Special Purpose Vehicles (SPVs) have been created to handle narrow, specific or temporary objectives of water resources management. The Gujarat government agency can transfer assets to the SPV for financing or managing a large project without putting the entire agency or department at risk. Along with GGRC, there are other SPVs: the Sardar Sarovar Narmada Ltd. (SSNNL) for transferring water from surplus areas to scarce areas; the Gujarat Water Infrastructure Co. Ltd. to implement the Sardar Sarovar Drinking Water Supply Program; the Gujarat State Drinking Water Infrastructure Company Ltd. (GSDWICL) set up to purchase bulk waters from SSNNL and to sell to other users; the Sabarmati Riverfront Development Corporation (SRFCDL) to oversee the riverfront development project to clean up the river by flushing out the effluent and sludge in the riverbed.

In addition, the power sector reform was undertaken to unbundle the State Electricity Board into a power generation company and regional power distributors. The privatization led to major reduction in transmission and distribution losses, which were mainly due to power theft from the feeders, particularly in rural areas by farmers. Also, its metered tariff regime (pro rata pricing) led to increased efficiency in groundwater pumping

and sustainability of groundwater use which is regarded as a successful case of water demand management.

Community-centered: Stakeholder Participation and Coordination Mechanism

Gujarat Water Users Participatory Irrigation Management Act was established in 2007 to encourage participatory irrigation management by water users. To facilitate community-level water management and local participation, the Pani Samitis or Village Water Committees, were established. They are expected to deal exclusively with O&M at local levels and are given less than a 50% share of taxes collected. Their responsibilities include power to enforce rules, regulations, and impose penalties. However, their effectiveness is limited as they do not involve other grassroots organizations that could enhance the discharge of their functions.

Other community-centered initiatives include the Sardar Patel Participatory Conservation Project (SPPCP) and the Participatory Water Conservation Program. The purpose of these projects is to involve designated beneficiaries or NGOs in constructing check dams and village tanks/ponds, with technical and financial assistance from the district office as part of small water harvesting schemes. These schemes promoted decentralization of water resources management by giving authority to local village Panchayats to identify sites, prepare estimates, and secure funds directly from the water resources department for execution of schemes. However, the implementation of the SPPCP scheme lacked serious hydrological and technical assessments of the total amount of utilizable/"uncommitted" flows in the river basins. This resulted in over-appropriation of water.

The Water and Sanitation Management Organization (WASMO) was created for community-level water supply management (more than 16,700 water and sanitation committees have been formed). This indicated a shift in the role of the state government from a service provider to a facilitator in water management by empowering village level institutions, i.e. Pani Samiti, through extensive capacity-building and facilitation. This system has brought about effective citizen engagement through its innovative governance model for community-led water supply throughout the State of Gujarat.

Performance

Economic: Regional Economic Growth

The increased levels of groundwater tables indirectly resulted in reducing the huge economic cost of energy for pumping groundwater, and also contributed to the incremental income of well irrigators. The Gross Regional Development Product (GRDP) in Gujarat had improved from US\$17.42 billion in 2000 to US\$70.27 billion in 2012. An increase of agricultural productivity appears to have contributed to regional development in Gujarat.

Social: Improved Quality of Life

Regarding social performance, there were positive effects on the quality of life for 24 million people in water-short areas of Saurashtra, Kachchh, and North and central Gujarat. Narmada canal-based piped water supply had been effective for provision of sanitation facilities and promoting health and hygiene in the communities as well as improving the local environment. Also, the enhanced groundwater recharge diluted the minerals in groundwater, having positive health benefits. The Pani Samitis were formed delegating legislative power to local committees to manage village water supply.

However, the Sardar Sarovar Project (SSP) has received the lowest score in the social performance dimension. Most of the farmers have refused to give up their land for the SSP. Until 2010, only 17,000 hectare of land (42.5%) were acquired for SSP over a period of 30 years.



Photo by Nitin Bassi

Environmental: Enhanced Groundwater Recharge and Reduced Energy Used for Groundwater Pumping

The long delayed 250 MW head powerhouse has been operationalized, and from 2004 to 2010 SSP generated 15,070 million kWh of eco-friendly energy. Positive environmental impact resulted from enhanced groundwater recharge and reduced energy use for groundwater pumping.

Findings and Policy Implications

Better coordination is needed among government departments responsible for water management.

Although drawing up the National Water Policy is the responsibility of the Ministry of Water Resources, the ministry has no full mandate to handle freshwater issues. The draft policy does not constitute comprehensive policy measures to be implemented at the national level. In addition, there is a lack of umbrella legislation at the national level. Gujarat drafted a state water policy, however, the policy has not been finalized yet.

Water rights need to be specifically defined.

In the absence of well-defined water rights, the opportunity cost of using water is very small in most situations. Water is inefficiently used in agriculture for growing water-intensive crops or appropriated by those who pay more rather than people who need it more. As the Gujarat case indicates, a well-defined water right system is more significant for heavy water users such as the irrigation sector. Also, this has entailed



Photo by Nitin Bassi

Figure 4-14. Sardar Sarovar Project Branch Canal (Left); Community Stand Post in a Village near Bhavnagar, Gujarat (Right)

growing inequity in terms of groundwater use especially for the resource-poor small and marginal farmers in semi-arid areas of the state. As access to groundwater is attached to land ownership rights, the resource rich farmers are likely to benefit more. To address equity and sustainability, water rights need to be established in volumetric terms for groundwater resources.

Water tariffs should be rationalized.

Although water tariff collection has improved with the formation of village water committees, the money collected from the water fees is not necessarily used to cover the water supply maintenance especially for the agricultural sector, the largest water user in most countries. Cost recovery would be improved if farmers paid on the basis of metering and if it were in parity with inflation.

Communities have to be empowered to manage the water systems.

Sustainable and equitable water management is possible only if local community institutions are capacitated and sufficiently empowered to play an effective role in governance at local level. Also, it is important that gender balance is considered in local water committees, as women are able to take care of domestic water and sanitation facilities and care about them the most. Also, skills required for operation and maintenance at local level, such as hand pump repair, can be taught to relatively uneducated people. Plus, technologically driven solutions such as micro-harvesting should consider needs of the poor farmers.

Proper follow up is needed after the technological services have been provided.

To ensure that installed facilities are used and maintained, services should be provided to follow up after technologies have been adopted. It seemed that villagers were not trained in operation, maintenance, and repair and did not understand the connection between clean water, sanitation, and disease. Similarly, farmers who install drip and sprinkler irrigation systems on their farms, were not trained in irrigation scheduling.

Background and Challenges: Energy Shortage and Lack of Access to Safe Drinking Water

Despite the large potential for hydropower generation (geographical conditions and ample water resources), Nepal suffers from energy shortage in rural areas. Most of energy supplies in Nepal originate from traditional sources: 68% wood, 15% agricultural waste and 8% dung, 7% petroleum, 1% coal and 1% hydroelectricity. The use of firewood, candles, and kerosene inside the household has resulted in indoor pollution. In addition, the limited access to drinking water is one of the main health hazards in Nepal.

The Nepalese government, United States Agency for International Development (USAID), Norwegian Agency for Development Cooperation (NORAD) and the United Mission to Nepal (UMN) jointly funded the Andhikhola Hydrel and Rural Electrification Project (AHREP). Local villagers contributed 9% of the total cost in form of

labor supply. The project created innovative and sustainable rural electrification approaches and developed local capacity, all of which have had a huge impact on Nepal's hydropower sector. The project was to supply electricity through small hydropower plants that produce up to 100kW (known as Micro Hydropower - MHP) to the people who are living in semi-urban and rural areas near Galyang Bazaar in the Syangja District, 280 km southwest of Kathmandu. The project started from 1982 and became operational in 1991.

Actions Taken

Market-based: Private Sector Promotion Policy and Cost Recovery

Since the 1990s, an array of legal institutions for the water sector has legitimized community participation and private sector involvement in decision making and in the management of water supply and irrigation systems. The main legal framework consists of the *Water Resources Act 1992*, the *Hydropower Development*



Source: <http://www.bpc.com.np/>

Figure 4-15. AHREP's Location

Policy 1992, the Electricity Act, and the Industrial Enterprises Act 1992. The AHRE Project is owned by the Butwal Power Company Limited (BPCL), a private company established in 2003 and in charge of operating the project. Consumers can adjust their consumption to avoid facing higher costs. Rural consumers who have the lowest incomes can access 25 and 50 watt current categories.

The Nepal Electricity Authority (NEA) is a public utility that acts as a single power buyer. The NEA purchases 27 GWh of electricity per year from the AHER Project through the Purchase Agreement, and the amount of 10 GWh is distributed for rural electrification. Each year, about 10% additional rural households are provided electricity. From the beginning of the project, the main electricity tariff policy of the AHER Project was to set a tariff that would be affordable for local consumers, thereby saving costs of operation and maintenance. Cut-out devices were used to limit the maximum consumption at each household. This enables the company to serve the poorest customers who have minimal energy needs and reduces costs by eliminating meter reading.

Community-centered: Stakeholder Participation

The local community and Village Development Committees were involved in developing many of the innovative approaches. Local communities were informed of various problems and trained to understand electricity. Hundreds of local people gained skills during the construction period.

Later, many were employed in the operation and maintenance of the power plants and went for other jobs. The policy for local employment, the community-based approach, maximum involvement of local technicians, engineers, and local workshops have strengthened local capacity in the community, hydropower construction, and operation and manufacturing sectors.

Performance

Economic: Local Development

Overall, the installation of AHREP resulted in socio-economic development in the region. The implementation of the AHREP is in line with the Andhi Khola Irrigation Project, resulting in better access to water and electricity services, more opportunities for employment and more production in agriculture. People have gained improved access to water and electricity services.

According to the World Bank, the Nepalese Gross Domestic Product (GDP) was US\$19.21 billion in 2012. The GDP for Nepal over the period between 1960 and 2012 averaged s US\$ 4.29 billion, reaching an all-time high of US\$ 19 billion in 2011. The access to basic services contributed to regional development and economic growth in Nepal.

Environmental: Increased Environmental Awareness

The AHRE Project was accompanied by strong community engagement. The Users' Organization (UO) was encouraged, and it stimulated community commitment and contributed to raising awareness. The project encouraged vulnerable groups to participate in community development activities and served as a communications link between the community and BPCL. The strategy of the UO encouraged women's participation in the electrification process of their community, as they were asked to collect fees and work on other administrative issues.

Social: Quality of Life and Public Health Improvement

Electric lighting provided by the project enables children to study more comfortably and conveniently in school and at home and improves the quality of life. Also, access to electricity eliminated the need for people to use firewood, candles, and kerosene, reducing indoor pollution that causes health problems.

Findings and Policy Implications

The environmental dimension should be considered from the initial stage of designing water infrastructure.

The project established Micro Hydropower which represents eco-friendly infrastructure, even though the respondents did not observe remarkable progress in the environmental sector. Renewable energy development should be tailored to local characteristics.

Approximately 74% of the total annual surface water is available between June and September in Nepal. Due to the imbalance in the distribution of water, water stored in reservoirs and used for micro hydropower (MHP) can be regarded as one of the most feasible options.

Pro-poor policy measures can be used to achieve green growth.

Pro-poor policy is necessary when designing a Water and Green Growth project in developing countries. In order to make electricity services more affordable for low-income customers, a tiered tariff is used in the AHRE Project. The different tariff structures allow electricity supply to different strata of the rural communities and generate additional incomes for maintenance and operation.

Private sector participation can enhance efficiency of project operation.

Market-oriented policy is considered a key to implement green growth in Nepal. The Nepalese government promoted private sector participation with enactment of the law. Hence, a private enterprise in the form of BPCL runs the project and uses market instruments to lower the unnecessary costs for low-income households. According to the questionnaire results, it seems to be generally considered that the government has had only a limited role and influence in the project.

Exogenous factors affect policy selection criteria.

The growth in population in the 1980s and 1990s brought with it an increased demand for energy supply in the country, which already faced a serious level of energy shortage. Faced with the challenge of rising energy demand, the Nepalese government carried out the plan for hydropower development. Political instability can be identified as one of the most serious obstacles for Nepal's growth and development. According to Transparency International, 90% of Nepal's population believes that political parties are corrupt, and 85% of the population considers public officials and servants as corrupt. Nepal's unstable political situation in previous years had an influence on the level of private sector involvement in the economy. In politically unstable countries like Nepal, rather than state-driven policy instruments, market-oriented instruments can be more effective.

Background and Challenges: Water Quality

Under Korea's first *Five-Year Economic Development Plan (1962)*, Ulsan was designated as the 'Ulsan Special Industrial Zone,' the first industrial complex in the nation. As planned, the city was rapidly urbanized, as automobile factories, shipbuilding yards, oil-refinery and petro-chemical industrial complexes were built, with the population migrating to the area in search of employment opportunities.

To accommodate the increase in demand for industrial and domestic water use, large-scale dams were constructed. This resulted in insufficient volume of water downstream to sustain environmental flow. Along with this, the water quality drastically fell with industrial wastewater and domestic sewage pouring into the river without proper treatment. At the time, "growth first, clean up later" paradigm was widespread and environmental awareness was extremely low, providing loopholes to continue



Source: Wikipedia

Figure 4-16. Location of Ulsan

such practices. In 1996, Taehwa River reached its worst level of water quality (BOD 11.3mg/l). Following numbers of mass fish deaths, the incidents were reported on national television. This gave rise to the River Revival Campaign, leading to nation-wide recognition on the severity of the situation. Despite the attention and efforts, polluted water continued to flow into Taehwa and the problem continued to make headlines in the media.

Actions Taken

State-driven: Well-organized Indicative Plans Led by the Local Government

The Taehwa River Restoration Project was carried out under the leadership of Ulsan municipality. Its strong will and commitment was crucial to its success. Starting in 1997, the municipality embarked on an array of local development projects establishing the goal of eco-city construction as a means to tackle the environmental pollution. In 2005, Ulsan established the *Ecopolis Ulsan Declaration* and the comprehensive *Taehwa River Master Plan*.

The *Master Plan* embraced a myriad of short-term and long-term objectives, through tangible and intangible measures. It included water quality improvement, creation of water-friendly space, environmental rehabilitation, cultural festivals, and environmental educational programs, with the Taehwa River Restoration Project as its priority. Also, a multi-stakeholder participation and discussion platform was created that included local companies, social organizations, and residents in policy decision-making.

Market-oriented: Private Sector Participation Policy

The project has been mostly financed with general taxes and bonds from the central and local government. To alleviate the financial burden, the Ulsan Metropolitan Government invited the private sector to fund some of its projects such as the construction of sewage treatment facilities. The municipality introduced corporate social responsibility (CSR) projects with package of incentives not only to increase private investments

but also to encourage motivation for companies to participate in solving local environmental problems.

Community-centered: Stakeholder Participation and Coordination Mechanism

Ulsan's success story would not have been possible if it were not for close cooperation among stakeholders. Under Ulsan's initiative, Green Ulsan 21 Environmental Committee was formed for stakeholder participation in policy making and as a conflict resolution mechanism. Policy and planning information on the river was disclosed and made easily accessible to the public, and their feedbacks were adopted.

The local government delegated the environmental monitoring responsibilities to its citizens and encouraged local companies to provide financial support for welfare enhancing and conservation activities. Such an approach allowed local stakeholders to transform themselves from mere policy beneficiaries to principal actors for environmental conservation.

Performance

Economic: Regional Economic Growth

Ulsan's GDP per capita was ranked as no. 1 from 2009 to 2012 among metropolitan cities and provinces in Korea, reducing wealth concentration in the capital area. Its regional economy was revived with increasing number of visitors (6 million in 2000 to 30 million in 2012).



Environmental: Improved Water Quality and Biodiversity

The water quality and biodiversity of Taehwa improved significantly. The BOD level was reduced from 11.3 ppm in 1996 to lower than 2ppm after 2011. The number of species identified increased from 56 in 1996 to 272 species in 2013. Ulsan was able to successfully transform a once heavily polluted city into an eco-city, with a long-term paradigm that promoted sustainability and resulted in new business and employment opportunities.

Social: Improved Quality of Life and Stakeholder Participation

Taehwa River Grand Park became a leisure/recreational space for not only the residents but also for its visitors. This contributed to increase in quality of life for its residents and enhanced the city's reputation.

The institutionalization of stakeholder participation in policy making and delegation of administrative responsibilities (e.g. environmental monitoring) increased ownership and commitment of the public and local community, which contributed to the success of the WGG approach.

Key Findings and Policy Implications

An industrial city can be transformed into an ecological city.

Ulsan has transformed itself from a pro-growth industrial city without environmental infrastructure to an eco-polis through the adoption and implementation of environmental preservation policies, including the ecological restoration of the Taehwa River.



Source: Taehwa River White Paper

Figure 4-17. Young Salmon (Left); Sweetfish (Right)



Source: Taehwa River White Paper

Figure 4-18. Changes in the Downstream of the Taehwa River

The policy process towards Water and Green Growth must be holistic and ensure sustainability in the long term initiated by a strong leadership.

The Ulsan Metropolitan City has prioritized the Taehwa River Restoration Project and has carried out the project with a strong political will. The goals of the Taehwa River were to improve water quality and to raise the quality of life. The long term plans of the project included both tangible and intangible aspects such as the expansion of basic environmental facilities, the creation of the Taehwa River Grand Park, various cultural festivals, and public education programs.

A higher average income, relatively equal wage level, political stability and advanced technologies contribute to success of the project's performance.

Economic growth in the city contributed to the increase of tax revenues and has positively contributed to sound financing for the ecological restoration project. In order to tackle environmental problems, cooperation between social groups is necessary. The high income level of Ulsan encouraged the general public to be more concerned about the quality of environment, while a good level of social equity strengthened stakeholder participation in Ulsan. Policy-makers, related government agencies, and the beneficiaries were all participating in the projects, and therefore, complaints or relevant conflicts were minimized on the basis of mutual understanding and trust. The political stability of Ulsan area has resulted in avoiding political stress in the project period and has guaranteed the consistency of the project. Advanced

technologies in Korea have contributed to the success of the project through scientific research on water quality enhancement and hydrological environment research, and ecosystem restoration.

Stakeholder participation can enhance the overall performance of the project.

Environmental pollution including the deterioration of water quality in Taehwa River and the rise of society's interest had elevated the priority of local government's policy and provided incentives for solving problems by investing financial and human resources. The Ulsan municipality has created the Green Ulsan 21 Environmental Committee, which has institutionalized stakeholder participation. The municipal government has also delegated activities to the local community such as environmental awareness programs and environmental monitoring. These have helped improve the overall performance of the project. In order to increase environmental awareness, the Ulsan municipal government has made documentaries and has been engaged in other public relations efforts, which resulted in increasing residents' interest and participation.

Background and Challenges: Environmental Objectives

The Ebro River Basin, which accounts for one fifth of Spanish agrarian production and about one third of its meat supply, has experienced rapid economic growth from the late 1990s mostly due to the availability of reliable water (108 large dams) for agriculture, industry, energy, and tourism. Rainfall is unevenly distributed in the area, ranging from 3,800 mm/year in the Pyrenees Mountains to just 100mm/yr in the central river valley where the main economic activities are located.

The Ebro River Basin has been managed at the basin level since 1926 by the Confederación Hidrográfica del Ebro (CHE), one of the earliest river basin authorities in the world. The main objective of water management in the basin during the early period was to promote and coordinate building and operation of water infrastructure primarily to support agricultural development and to meet increased demands from economic growth.

The Ebro River has been affected by diffuse pollution coming mainly from agricultural and industrial runoffs and livestock waste. Some areas are vulnerable to nitrate pollution and uncertainties from climate change. *The Ebro River*

Basin Management Plan provides the framework for water management to facilitate continuous economic growth in the region. The Plan is required by the Spanish Water Act and responds to the European Union Water Framework Directive (WFD) that demands higher water quality objectives and great public participation than were formerly required by CHE.

Actions Taken

State-driven: Technology Promotion Policy, Indicative Plans, and Balance among Government Layers

In Spain, Hydrographic Confederations are the main water management bodies that are attached to the Ministry of Agriculture, Food and Environment. In implementing its *Hydrological Plan*, CHE has to engage all stakeholders including government organizations, autonomous communities, local authorities, private sector, including energy producers and agrobusiness, and representatives of the civil society.

Market-oriented: Private Sector Promotion Policy

The market-oriented institutions were effective in sound water planning of the Ebro River basin. Private sector participation has mainly occurred through State Water Corporations that were created from 1997 as a policy instrument to promote hydraulic works, to involve users in the development and operation of water infrastructure, and to enhance access to private funding. There are three companies that operate in the Ebro Basin and are overseen by the Ministry of Agriculture, Food and Environment.

Acuamed (Aguas de las Cuencas Mediterráneas S.A.), a state-owned company, is the main instrument for the AGUA Program that is responsible for contracting, construction, acquisition, and operation of all hydrological public works. One of its major tasks is to eliminate chemical pollution in the Flix Reservoir Project. This entails extraction, treatment, and removal of sludge, as well as restoration of the Ebro's ecosystem, affecting 800,000 residents living in Tarragona. AcuaEs (Aguas de las Cuencas de España S.A.) has a key role in construction and management of water-related



Source: Ebro River Basin Confederation

Figure 4-19. Map of Spain Showing Location of Ebro River Basin and Administrative Boundaries of the Ebro River Basin Region

infrastructures (e.g. irrigation projects, regulation infrastructure, major irrigation channels, and domestic supply schemes). It can work in collaboration with other players such as local and regional governments or other institutions that determine the specifics of financial arrangements and cost recovery. Lastly, SEIASA (Sociedad Estatal de Infraestructuras Agrarias S.A.) executes works of irrigation modernization and consolidation. At the municipal level, water recycling is managed by public, private or mixed capital companies.

Importantly, the promotion of private sector participation led to increased production in water-saving irrigation technologies. The Spanish Water and Irrigation Manufacturers Association (Asociación de Fabricantes de Agua y Riego Espanoles or AFR) represents, promotes, and develops Spanish irrigation technologies.

Community-centered: Stakeholder Participation and Coordination Mechanism

The Water Act regulates local water supply through statutes approved by the users. These statutes specify the location and purpose of each use of public water supply, and decision making on the statutes includes representation and participation of users. All the users are to contribute tariffs in adequate proportion to common expenses of operation, maintenance, and improvement. Also, water users sharing the same concession or intake can organize themselves into User Communities such as Irrigators Communities.

In addition, *the WFD* requirement has ensured public participation on three different levels: access to information useful

to society; public consultation on documents and opportunity to make comments and suggestions for amendments; and active participation of the concerned stakeholders/users. Stakeholder participation is achieved through meetings of representatives of major economic activities and citizens' groups, ensuring dialogues between competing sectors. The balance of power within CHE is roughly divided as follows: one third for the users' representatives; one third for the autonomous regions representatives; and one third for representatives from governing bodies, management bodies, etc. Such effort has contributed to creating a catalogue of potential measures (from around 10,000 proposals and contributions) from up to 107 meetings in 26 sub-basins among 2,785 representatives of stakeholders.

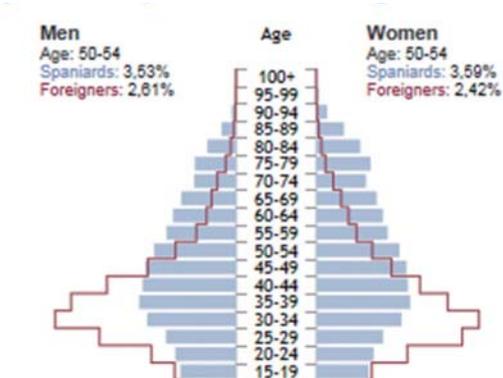
Performance

Economic: Technological Advancement

In economic performance, technological advancement was the most obvious. In particular, the Automatic Hydrological Information System (SAIH), was one of the best accomplishments of the Ebro planning process. High quality and real time information enabled stakeholders to prepare for floods, droughts, and other emergency situations. Flood control is supported by information and early warning systems through SAIH, but also with new systems such as Flood Zone Mapping System and Flood Risk Management plans. These will help minimize the risks of damages to property and persons.

Environment: Water Quality Improvement

The Ebro River Basin Management Plan had set a goal of reaching 'good status' (standards set by the *EU WFD*) for 83%



Source: Confederación Hidrográfica del Ebro

Figure 4-20. Meetings with Representatives of Recreational Activities Sector (Left, 2006) and Energy Sector (Right, 2007)

of the water bodies by 2015. In 2011, 71% of the water bodies assessed were already of a good ecological status and 78% of groundwater bodies had achieved that status. Improvement of water quality had been effective for domestic water supply. Other achievements of high environmental performance include: the highest quality water is being produced for human consumption in the larger cities, such as Zaragoza, Huesca, and Lleida; restoration of rivers, streams, and wetlands; and new recreational activities.

Social: Stakeholder Participation

The increase of stakeholder participation was the key to a good result in the social performance dimension. Local communities organized more than 100 meetings across the river basin and almost 3000 representatives of social and economic groups, irrigators, local authorities, and other public entities and organizations were involved.

Findings and Policy Implications

Integrated water planning and management have contributed to green growth.

CHE adopted an integrated water resources management by acquiring a multidisciplinary technical staff and has further opened the planning process to public, resulting in increased ownership of the process by stakeholders. *The Ebro Hydrological Plan*, a comprehensive plan that targets the basin in general, has strengthened institutions at the river basin and sub-basin levels. The ability to transcend administrative boundaries has been effective in reducing the number of fragmented interventions.

Measures for promoting green growth need reinforcement.

The Ebro region's experience and expertise with water-saving technology, sound planning to improve water use, particularly in irrigation, and controlling the associated diffuse pollution helped the region weather the economic downturns. These measures are effective for both enhanced economic productivity (potential new crops, more efficient workforce and stable water supply, generating knowledge and technology to improve water use efficiency) and for environmental improvement (less pollution affecting water ecosystems, shift towards cleaner production systems). The Ebro Valley generates around one fifth of agricultural and agri-business production in Spain. Agriculture in the Ebro region has performed

better than in the rest of the country over the past decade. The irrigation sector facilitates the diversification and intensification of crops. An average GDP of agriculture in the period between 2009 and 2011 reached around €3,100 million per year, which represents an increase of 1.8% over the period from 2000 to 2002 (as compared to declining trends elsewhere). Therefore, the potential to generate green growth from measures that address water-related challenges is very high.

Technological innovation and accurate information improves reliable water management.

Technological improvements in modernizing the irrigation systems in the Ebro Valley played a substantial role in raising agricultural productivity, supported by a reliable supply of water for irrigation. Private sector companies have been instrumental in developing and disseminating water-saving technologies. Technological advancement increased resilience against disasters and other challenging situations. The R&D expenditure (% of GDP) had increased from 0.91% in 2001 to 1.35% in 2011. Also, the number of patent applications at the national level had increased from 318 in 2000 to 772 in 2013. Spain has become a leader in several specific areas, especially in the industries of aerospace, renewable energies, and water treatment. Technological advancement was the most obvious in economic performance. The Automatic Hydrological Information System (SAIH) is considered one of the best accomplishments of the Ebro planning process. The system provides high quality and real time information that enables stakeholders to prepare for floods, droughts, or other emergency situations.

Background and Challenges: Water Quality

The historical Golden Horn Estuary of Istanbul had been an industrial area since 1937. Much of the area was polluted and lacked infrastructure planning, exacerbated by overpopulation. The Golden Horn became an ugly storage area of gray city-sewage and industrial waste with a terrible odor. One-third of the estuarine surface area was filled to accommodate factories and their associated tenements with no provision for industrial or domestic waste disposal or treatment.

By 1985, the extensive industrial zone around the Golden Horn, including active operation of dockyards, factories, and warehouses, had increased pollution of the estuarine waters. The results were devastating, and the estuary turned into a shallow, dead lagoon where the boats could not move, where there were no living species and the smell from anaerobic degradation could be detected from several kilometers away.

In addition, the level of available water resources was decreasing every year, and water demand in Turkey had doubled over the course of the 20th century. The huge burden of 200,000 tons of wastewater discharge (67% chemical waste, 27% wash water, 4%

cooling water, and 2% waste water) had driven the Greater Istanbul Municipality to seek solutions. This quest culminated in the launch of a multidimensional plan, the Golden Horn Rehabilitation Project, aimed at improving water quality and navigation. The project consisted of five phases: investigation, dredging, construction of wastewater facilities, landscaping, and repurposing the area as a tourism and cultural destination, with much focus on dredging and prevention of sewage from entering with treatment facilities.

Actions Taken

State-driven: Regulations and Legal Instruments

The water-related legal and institutional framework in Turkey defines various tasks in water management and provides relevant organizations with the responsibility to undertake related works. According to the *Law on Domestic and Industrial Water Supply*, the DSI (State Hydraulic Works) has been responsible for the implementation of major water projects including construction of dams for irrigation and hydropower since the 1950s.

The Law that established the Istanbul Water and Sewerage Administration (ISKI) in 1981 defined the tasks of ISKI, which is the responsible entity for water supply, water infrastructure and



Source: <http://content.answcdn.com/main/content/img/factbook/maps/tu-map.gif>

Figure 4-21. Map of Turkey, Showing the Location of Istanbul, the Bosphorus Strait and the Sea of Marmara

construction, operation and maintenance of relevant facilities, and law enforcement for the prevention of water pollution in the city of Istanbul. ISKI contributed substantially both financially and technically to the Golden Horn Restoration Project, in collaboration with the Istanbul Metropolitan Municipality (IMM). In that project ISKI's financial contribution was US \$480 million and IMM's contribution was US \$173 million.

Market-oriented: Private Sector Promotion Policy and Cost Recovery

Among the most significant improvements in terms of private sector involvement in the water sector was the encouragement of private sector participation in energy production. In this way, the burden on DSI was partly shifted to the private sector, which became the lead actor in construction of small dams and hydropower stations.

The ISKI is responsible for the water and wastewater infrastructure in Istanbul. Water tariffs are also determined by the ISKI based on a full cost recovery principle under *the EU Water Framework Directive (WFD)*. Most of the budget of the ISKI comes from the revenues obtained from the collection of water tariffs. The level of water tariffs in Istanbul includes water treatment costs in line with the polluter pays principle of the EU. Autonomous municipal water services administrations such as the ISKI operate on an independent budgetary basis. ISKI's ability to collect fees became the main source for project development and implementation, allowing for well-planned financing and mobilization of monetary resources. Also, this method allowed for cutting subsidies to agriculture and decreasing the financial burden on state institutions.

Community-centered: Stakeholder Participation and Coordination Mechanism

Well-coordinated efforts of all different stakeholders and political support were necessary for such a long-term project. Local people, private sector, academia, and NGOs have been consulted to varying degrees and were informed properly at different phases of the project, with Istanbul Metropolitan Municipality and ISKI as lead actors. One example of a positive outcome of community participation is the Fener-Balat Rehabilitation Project (a sub-project of the Golden Horn). A multifunctional social center was opened for public meetings and educational activities to raise awareness among local peoples, and the historic Balat Bazaar was renovated in consultation with shop owners.

Performance

Economic: Technological Advancement and Local Development

The vision of *the National Science, Technology and Innovation Strategy (2011-2016)* is to disseminate a culture of multilateral and multidisciplinary Research, Development and Innovation (RDI) cooperation in areas such as energy, water, and food. This is to encourage small and medium-sized enterprises (SMEs) to become stronger actors within the national innovation system, and to enhance the contribution of research infrastructure to building the Turkish Research Area.

With technological advancement, local development was one of the significant effects. The Golden Horn area hosts remarkable landmarks that ensure socio-economic added value. Particular cultural facilities such as museums, an amusement park, and a theme park facilitated impressive



Photo: Murat Ayan

Figure 4-22. Golden Horn before 1996 Restoration (Left); Golden Horn after Restoration (Right)

socio-economic and cultural development. The total revenue of private museums along the estuary reached US \$33 million in 2010, compared to US \$5 million in 2000. The theme park and shopping center were created on a 600,000 m² area, and 30 million visitors are expected annually. A gigantic amusement park, named Vialand, will provide employment opportunities for 4,500 people, and approximately 70% of the workforce are expected to be hired from nearby districts.

Environmental: Improved Water Quality and Biodiversity

The project had a positive impact on marine life and biodiversity and resulted in an increase in the fish population. A large increase in the number of aquatic species has been observed, and hand-line fishing, which was absent from the region for a long time, is again contributing to the well-being of local residents.

Social: Improved Quality of life and People's Health

The Golden Horn Restoration Project created a safer and healthier environment that is integrated with the city. It improved the quality of life with better infrastructure, protections against earthquake risk, and improved the use of cultural amenities through tourism-related facilities.

Findings and Policy Implications

Technology advancement and innovative repurposing contributed to overall socio-economic development.

Turkey is a leading country in scientific development, ranked 18th in the world in research output, according to an Elsevier Science survey. Much of the success of the Golden Horn Project hinged upon the technical strength of the country. For instance, the sludge dredging technology has succeeded in removing heavy metals and improving the overall quality in the estuary. Moreover, many private businesses and individuals came up with innovative ideas for repurposing and reusing some of the run-down facilities that led to solid economic investments. Examples include: an electricity power plant that was turned into an energy museum; an old fez factory became a cultural center; and a cigarette company was transformed into a university campus. This type of innovative repurposing preserves the authenticity of the region and saves money on construction. Technical innovations can accelerate the development of green technologies that support long term growth.

The role of the local government had a more positive impact on the project than the central government.

In the Golden Horn case, respondents showed an evident consensus on the dominant role and influence of the local bodies (ISKI and IMM) as compared to the central government. Local government was the main decision-maker throughout the whole project, supported by central government branches to some extent. In fact, the existence of exclusive water departments did not guarantee a well-coordinated water management. Due to large size of the country, decentralization and autonomy of the local government enabled effective operation and reduced unnecessary administrative procedures.

Political coordination from the local to central government is necessary for the success of the project.

Coordination is needed among public bodies as well as across the private sector, universities, and civil society in order to make more informed decisions in such a large and complex undertaking as the restoration of the Golden Horn. Political alignment and a responsive relationship between the central and local government has been a crucial factor for the restoration of the Golden Horn Estuary and the continuous urban improvements. In the lead up to EU accession, Turkey is preparing river basin management plans that are expected to bring about a more holistic and inclusive water management system. The establishment of the Ministry of Forestry and Water Affairs and the Turkish Water Institute (SUEN) strengthens Turkey's attention to water management at the national and international levels and expands its collaboration with global actors. Turkey will have to apply river basin management plans carefully and consider varying conditions of each basin in order to achieve reasonable tradeoffs and meet the particular needs of basins.

A clear legal framework paves the way to implement policy.

According to *the Law on Waters (1926)*, municipalities are responsible for supplying and managing water for human use. Article 4 of this law states that supply, operation and maintenance costs should be met by municipalities. They are also responsible for ensuring the protection of water resources according to Article 9 of *the Law on Waters*. The Istanbul Water and Sewerage Administration (ISKI) is responsible for the whole water and wastewater infrastructure, contributing both financially and technically to extensive environmental pollution control projects of the Istanbul Metropolitan Municipality (IMM).

4.2 Analysis

Deriving Policy Implications from Findings

The WGG Project Team compiled a list of water-related institutions and policy instruments that were instrumental in achieving green growth, with generalized policy implications based on both qualitative and quantitative analyses of the 11 case studies. The effectiveness of these institutions and policy instruments were repetitively verified throughout detailed case analyses, and with some supported by results of quantitative methods.⁴⁾

As such, every reader should be aware of why the research adopted both qualitative and quantitative methods, with emphasis on the former. The quantitative method plays a complementary role in supporting generalized findings of the 11 case studies. The research extensively utilizes qualitative approach for analysis of each case study, examining its different development needs and objectives along with endogenous and exogenous factors (economic, environmental, social, political, and technical) that have shaped contexts of formation and implementation of institutions and their effects on project performance. Additionally, the methodological approach of the research is not without its shortcoming as results of quantitative analysis must be validated further due to limited number of complied cases in the model.

Therefore, the following key messages should be perceived as broad policy goals that decision makers should/may ideally pursue in path towards green growth. Keeping this in mind, it is up to them to decide what, when, how and possibly why certain institutions and policy instruments should be adopted. It is advisable that decision makers and experts look into each in-depth case study to devise and implement policies that better fit their different interests and contexts (see *Water and Green Growth Volume 2: Case Studies*).

Key Messages and Policy Implications

Based on policy implications derived from analyses, the WGG Project Team intends to deliver the following key messages. When reading this section, it should be noted that key messages are written in color and the following explanation under each key message entails policy implications.

Water is a vector through which green growth can occur.

State-driven, market-oriented, and community-centered institutions and policy instruments can have different effects on the performance of Water and Green Growth projects in different circumstances.

When establishing water-related policies or projects, the government should consider the trends of exogenous factors, such

as economic crises, demographic changes, and political stability. Moreover, endogenous factors such as water availability and how much water will be used in the future, influence the selection process and success of a project.

There is no one-size-fits-all strategy. Water and Green Growth strategies need to be context-specific from the initial stage of the project and throughout the implementation of policies or projects.

Water and Green Growth policies and programs must strive for economic, environmental, and social balance in order to be

A holistic approach to encompass the three pillars of sustainable development is essential for the implementation of Water and Green Growth projects and strategies.

successful. The integrated approach is based on the three pillars of sustainable development: 1) Water as an Engine for Growth (economic growth); 2)

Protection and Conservation of Water Resources (environmental protection); and 3) Water for an Improved Quality of Life (social development). When water project is pursued to improve regional economic development, environmental aspect is sometimes overlooked at an initial stage. It is important to take into account the three dimensions together from the beginning.

4) The full details of findings based on quantitative analysis can be found in Appendixes A and B.

State-driven Institutions

Determined political leaders who are champions of restoring and protecting water bodies and initiating water plans can drive green growth projects to success that result in major socio-economic improvements. Strong political will and commitment by leaders also contribute to consistency and sustainability of project implementation and completion.

Water planning is a powerful tool for identifying quantity and quality of water available for allocation among competing uses and for determining how to implement effective policies. In early stages of development, indicative plans can provide a broad vision for economic and social development at national and/or regional levels and allow environmental objectives to be integrated into land-use and water-use planning. The plan may include regulatory regime for development management of water resources and allocation, with appropriate institutional mechanisms to enforce them at the basin level.

Water and Green Growth plans and projects with clearly defined legal boundaries and responsibilities backed by government legislation, policy, and water-related organizations have much higher chance of completion and success. Where a legal framework is articulated, institutional risks (e.g. abrupt policy changes) and economic costs (e.g. water tariff changes) can be avoided and ensure the long-term feasibility of the project.

Better coordination among government and other actors enables efficient management of water resources. The responsibilities among actors should be clearly defined in water-related laws, policies, and organizations. Water reforms in some of studied

cases have been successful due to clear horizontal and vertical arrangement of institutions that have effectively mobilized different actors' participation and build their capacity in both decision-making and implementation processes, through coordination mechanisms with clearly set roles and responsibilities.

Up-to-date technologies can improve water resources decision making and management, water quality control and monitoring, irrigation operation and maintenance. Innovations from every day and bottom-up knowledge can also assist in reducing wastage and lowering water consumption, even if they are not considered high-tech. Incentives for technological innovation and R&D invite private sector participation and investment.

Market-oriented Institutions

Sustainable financial sources should be secured for water management and long term plans for green growth. Investing in new green infrastructures as well as expanding existing ones help to restore natural hydrological systems and protect ecosystems with a high benefit-cost return. Substantial long-term government investment provided the impetus to some of the successful Water and Green Growth initiatives. Although public funding has been identified as a main source of financing for large infrastructure projects, private financing including foreign direct investment (FDI) can augment public funding. Public-private partnerships (PPPs) can be a way to supplement limited public funding and technological and managerial capacity in the water sector.

Indicative planning tools can be used by governments or basin organizations to promote holistic economic and social development through sustainable management of water resources and maintenance of related infrastructure and to improve ecosystems.

A clear legal framework support Water and Green Growth projects in terms of consistency and continuity.

Increased investment dedicated to developing sustainable water services and infrastructure will yield high economic, environmental, and social returns.

Evaluation of ecosystem status should be undertaken when planning for or deciding water use and allocation, so that environmental needs (e.g. environmental flows) are met. Economic instruments can provide incentives or impose penalties which can be useful in protecting and conserving the environment. The PES schemes provide incentives to farmers, landowners, and other stakeholders in forms of cash and/or in-kind payments in return for conserving ecosystem services and using them to adequate value (OECD, 2012). Water funds and other forms of watershed payment schemes can also play an important role in development where local communities benefit from investment in sustainable livelihoods.

A water rights system helps to establish a reasonable set of water allocation principles. In some cases, water markets improve efficiency and flexibility by reallocating water to higher valued uses and in reducing/managing the risks faced by water users. It can also achieve environmental objectives. This is especially true for improving efficiency in agricultural water use and allocation given that water rights and entitlements for both groundwater and surface water are clearly defined.

Community-centered Institutions

Stakeholder participation is one of the basic elements for improving local and regional water governance and achieving sound decision making. Also, it can procure public support that can lead to success of Water and Green Growth projects. Identifying relevant stakeholders and establishing appropriate communication strategies at the planning stage are fundamental to ensuring the success of the project. Such mechanism can maximize project's economic, social, and environmental impact and its overall

Economic instruments such as tariffs, water rights trading, and payment for ecosystem services (PES) can be used as effective measures to safeguard environmental sustainability.

Well-defined water rights for both surface and groundwater are crucial to effective water management.

Stakeholder participation in design and decision making is valuable and necessary for reflecting the community interest, building support, and for conserving and protecting water resources.

efficiency. Decision-making regulations and procedures need to be established early so that community concerns can be addressed through consultations and dispute resolution mechanisms. Stakeholder participation is valuable and necessary for reflecting interests of the public and community.

Communities have traditionally respected their water resources and may have a great deal to offer from accumulated know-hows on management and knowledge of natural systems. Knowledge sharing is at two-way street. The case studies show how important it is to understand those traditions, history, and social/cultural relationships for effective and efficient water resources management. Empowering local communities, especially women, is needed to derive maximum benefits from water management initiatives. Village water committees require capacity building in operation and maintenance, and populations need to understand their rights and responsibilities. Capacity building could increase understanding of impacts of the project and assist local water committees to make wise decisions in regards to water management and environmental protection.

Educational programs and capacity building can increase environmental awareness and increase functional effectiveness of overall water resources governance.

Water information system that allows access to adequate and relevant good hydrologic, economic, and social baseline information supports decision making for effective water management.

Enhanced water and data information systems can provide essential decision support for effective water management.

Monitoring systems are needed to keep records of the different stages of design, operation, and management of the project, to assess the progress of the project, to identify weaknesses in its implementation, and to undertake corrective measures.

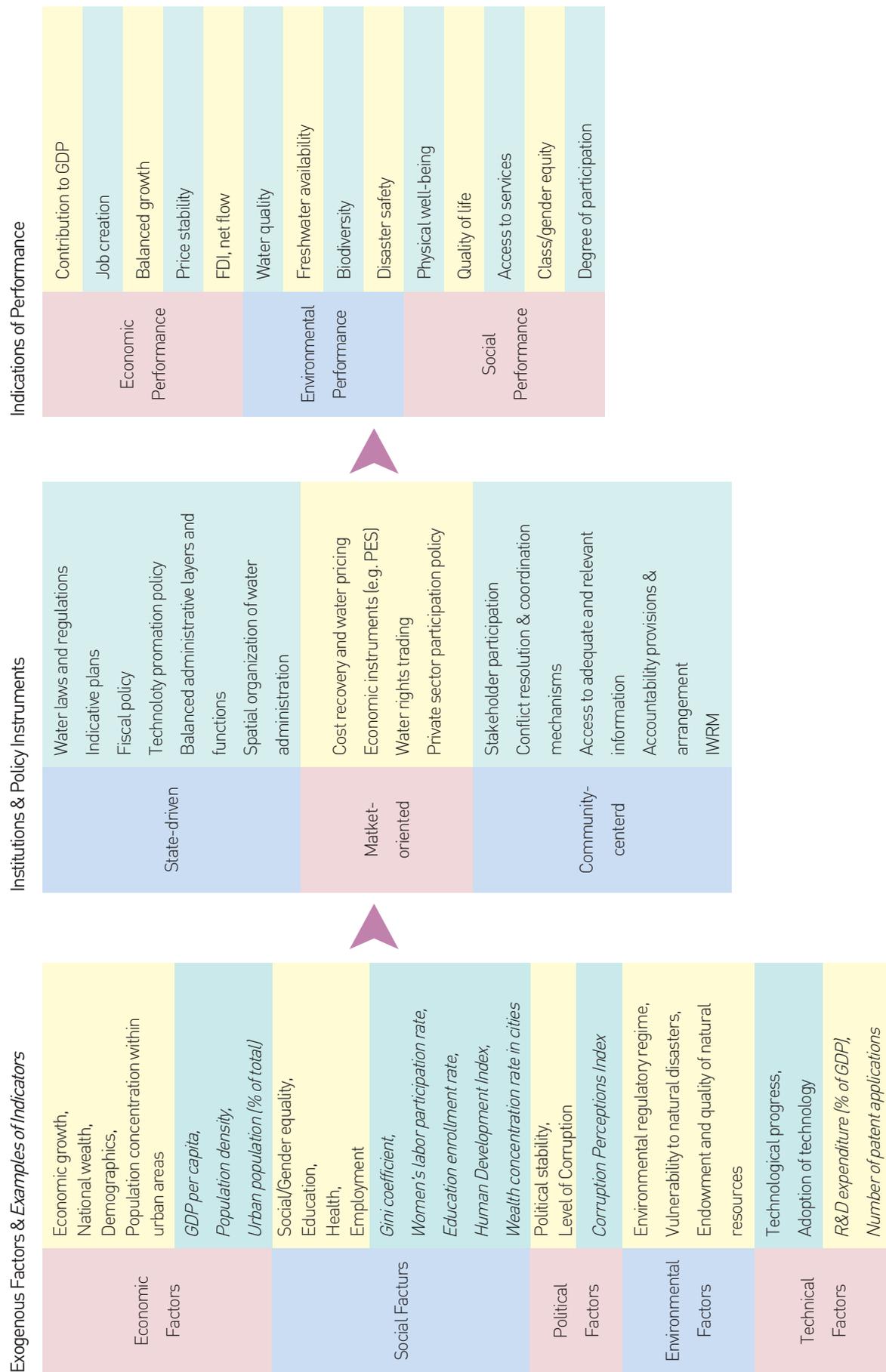
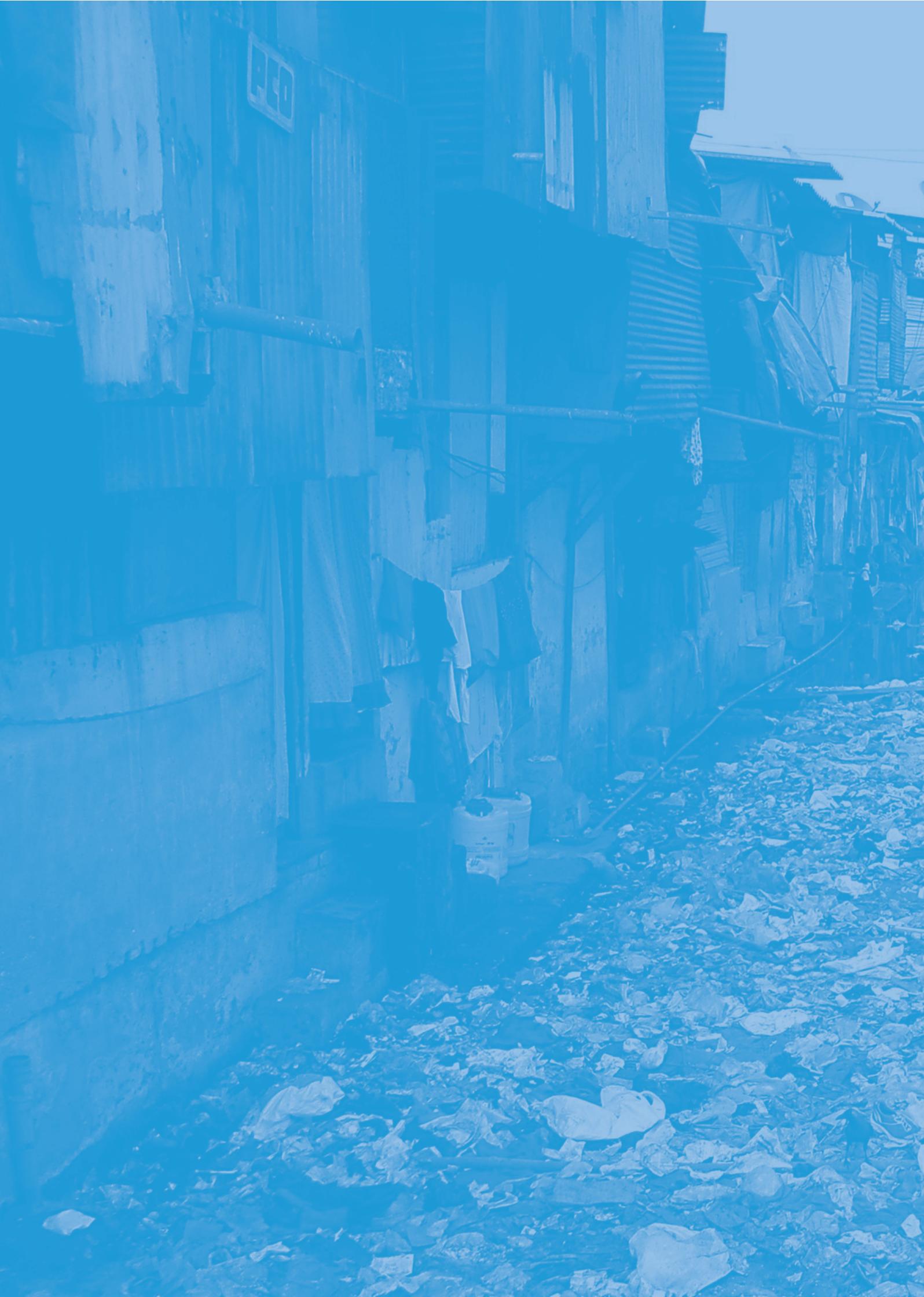


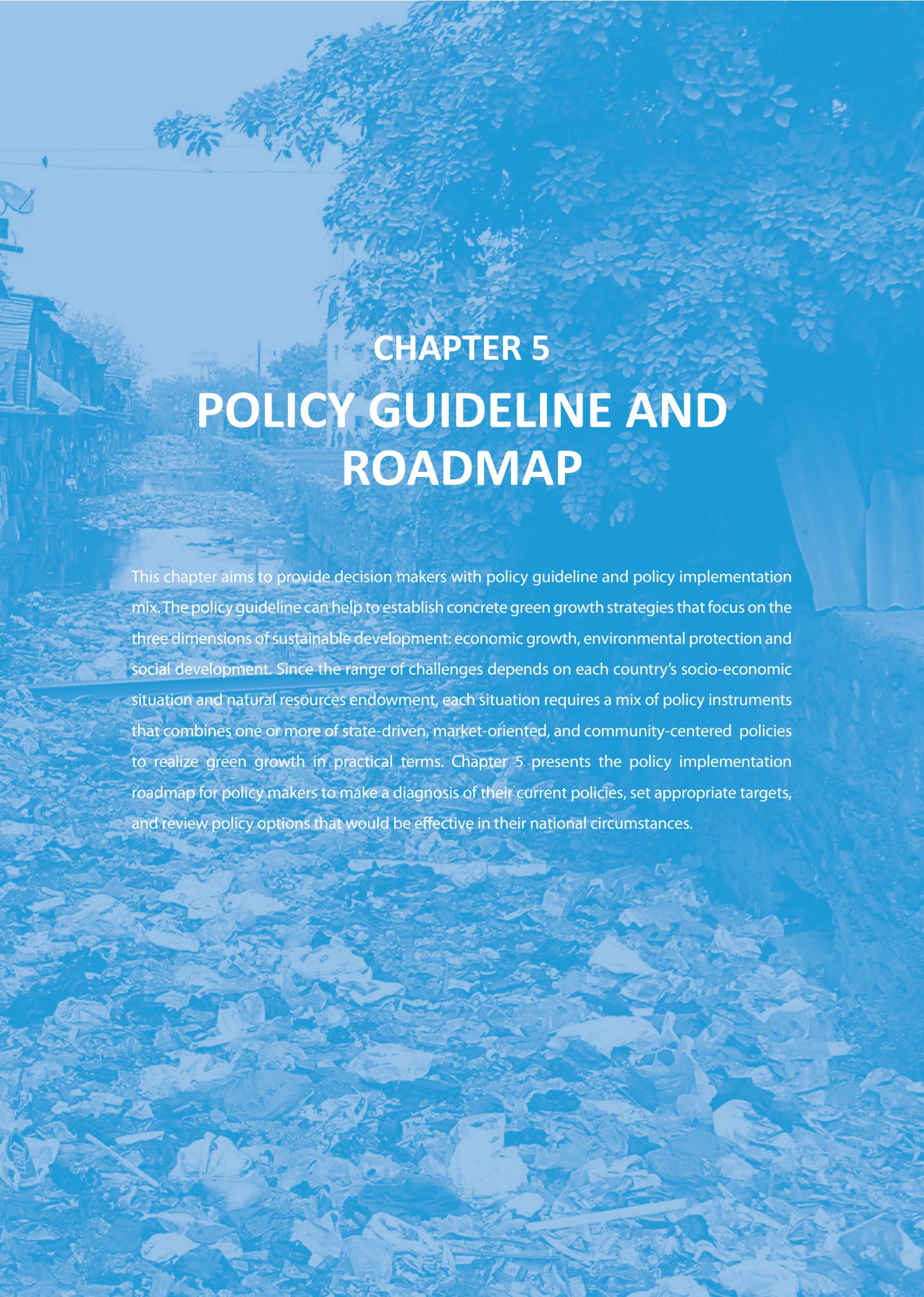
Figure 4-23. Relationships among Exogenous and Endogenous Factors, Institutions and Policy, and Performance of Water and Green Growth Projects

| | Exogenous Factors & Endogenous Factors | | | | | Policy Instruments | | | Performance | | |
|-------------------------|--|---|--|---------------------------|--|--------------------------------------|---------------------------------|---------------------------|---|--|--|
| | Economic | Social | Political | Technology | Environmental | State-driven | Market-oriented | Community-centered | Economic | Environment | Social |
| Sihwa (Korea) | Economic growth | Higher education enrollment | Political stability, Strong leadership | Technical developments | - | Indicative plans | Cost recovery | Stakeholder participation | Local development | Water Quality, Biodiversity | Quality of life, Stakeholder participation |
| MDB (Australia) | Economic growth, Urbanization | High HDI | Political stability | Technical developments | *Drought-prone | Indicative plans | Water rights | Stakeholder participation | Technological advancement | Environmental awareness | Citizen participation |
| IWRM (Brazil) | Economic growth, Urbanization | Improvement in HDI (education, health) *Regional income inequality | Decentralized implementation | Technological advancement | High level of available water | Indicative plans | Cost recovery | Stakeholder participation | Technological advancement | Environmental awareness, Water quality | Quality of life, Public health |
| Shanghai-Pudong (China) | Economic growth, Urbanization, Population growth | *Income inequality | Political support | High expenditure on R&D | *Vulnerable to disasters | Indicative plans, Tariffs | Private sector promotion policy | Stakeholder participation | Technological advancement | Water quality | Quality of life, Public health |
| Water fund (Ecuador) | Economic growth, High population density, Urbanization | Poverty reduction, Improvements in HDI | Strong leadership | High expenditure on R&D | Rich biodiversity | Regulations | Cost recovery | Stakeholder participation | Job creation | Environmental awareness | Gender equality |
| Desalination (Egypt) | *Slower growth rate, High population density | *Income inequality | *Political transition | High expenditure on R&D | *Water scarcity | Indicative plans, Financial support | Private sector promotion policy | - | GRDP, Technological advancement | Water quality, Biodiversity | Quality of life |
| Gujarat (India) | Economic growth, Urbanization, Industrialization | Poverty reduction, Improvements in HDI (education, health) | Political stability | Technological advancement | *Drought-prone | Financial support, Technology policy | Private sector promotion policy | Stakeholder participation | GRDP | Water quality | Quality of life |
| Andikhola (Nepal) | Population growth | *Income inequality, Improvements in HDI (education) | *Political instability | High expenditure on R&D | High level of available water, *Vulnerable to disasters | Tariffs | Private sector promotion policy | Stakeholder participation | GRDP, Local economic development | Environmental awareness | Public health, Quality of life |
| Golden Horn (Turkey) | Economic growth, Industrialization, Population growth | Improvements in HDI | Strong leadership, Political support, Balanced administrative layers and functions | High expenditure on R&D | High level of available water | Regulations, Financial support | Private sector promotion policy | Stakeholder participation | Technological advancement, Local economic development | Water quality, Biodiversity | Quality of life, Public health |
| Ebro (Spain) | *Sluggish economy recovery | Improvements in HDI | Decentralized implementation | Technical developments | - | Technology policy | Private sector promotion policy | Stakeholder participation | Technological advancement | Water quality, Disaster safety | Citizen participation |
| Taehwa (Korea) | Economic growth | High regional income | Political stability | Technical developments | - | Indicative plans | - | Stakeholder participation | Local economic development | Water quality, Biodiversity | Quality of life |

⊙: High effective ○: Effective / *Indicates negative impact on performance/GRDP: Gross Regional Domestic Product.

Table 4-1. Relationships between Exogenous and Endogenous Factors, Selected Policy Instruments and Performances of the Projects in Selected Case Studies





CHAPTER 5

POLICY GUIDELINE AND ROADMAP

This chapter aims to provide decision makers with policy guideline and policy implementation mix. The policy guideline can help to establish concrete green growth strategies that focus on the three dimensions of sustainable development: economic growth, environmental protection and social development. Since the range of challenges depends on each country's socio-economic situation and natural resources endowment, each situation requires a mix of policy instruments that combines one or more of state-driven, market-oriented, and community-centered policies to realize green growth in practical terms. Chapter 5 presents the policy implementation roadmap for policy makers to make a diagnosis of their current policies, set appropriate targets, and review policy options that would be effective in their national circumstances.

5.1 The Policy Guideline

Achieving Water and Green Growth objectives highly depends on a solid policy framework. Most international organizations and NGOs emphasize establishing and implementing appropriate policies, and related implementation strategies, which can have a far-reaching impact on economic growth, environmental protection, and social development.

A policy guideline for Water and Green Growth provides policy makers guidance on how to establish a whole process towards sustainable development with regard to water management, pursuing green growth in both developed and developing countries.

The WGG Project developed a draft policy framework (now called the policy guideline after revision), which was launched at the 6th World Water Forum (Marseille, March 2012). The new policy guideline has been elaborated and strengthened based on evaluation and case study analyses. The original policy framework

comprises the first three strategies in line with three pillars of sustainable development presented in Figure 5-1. The three strategies of Water and Green Growth comprised: Water as an Engine for Growth; Protection and Conservation of Water Resources; and Water for an Improved Quality of Life. These three strategies need to be incorporated into socio-economic development policies and plans for achieving green growth in the future.

It should be understood that policy directions contribute to achieving the three main strategies. These strategies should be pursued in line with strengthening water institutions, as discussed in the case studies and analyses. They should be supported by indicative basin and river planning; clear legal framework (e.g. water legislation); water management regulations; data management systems; mobilization of funds to ensure financial sustainability through the public budget, private sector participation; and an array of economic instruments such as payment for environmental services (PES) ; and stakeholder participation and coordination mechanisms.

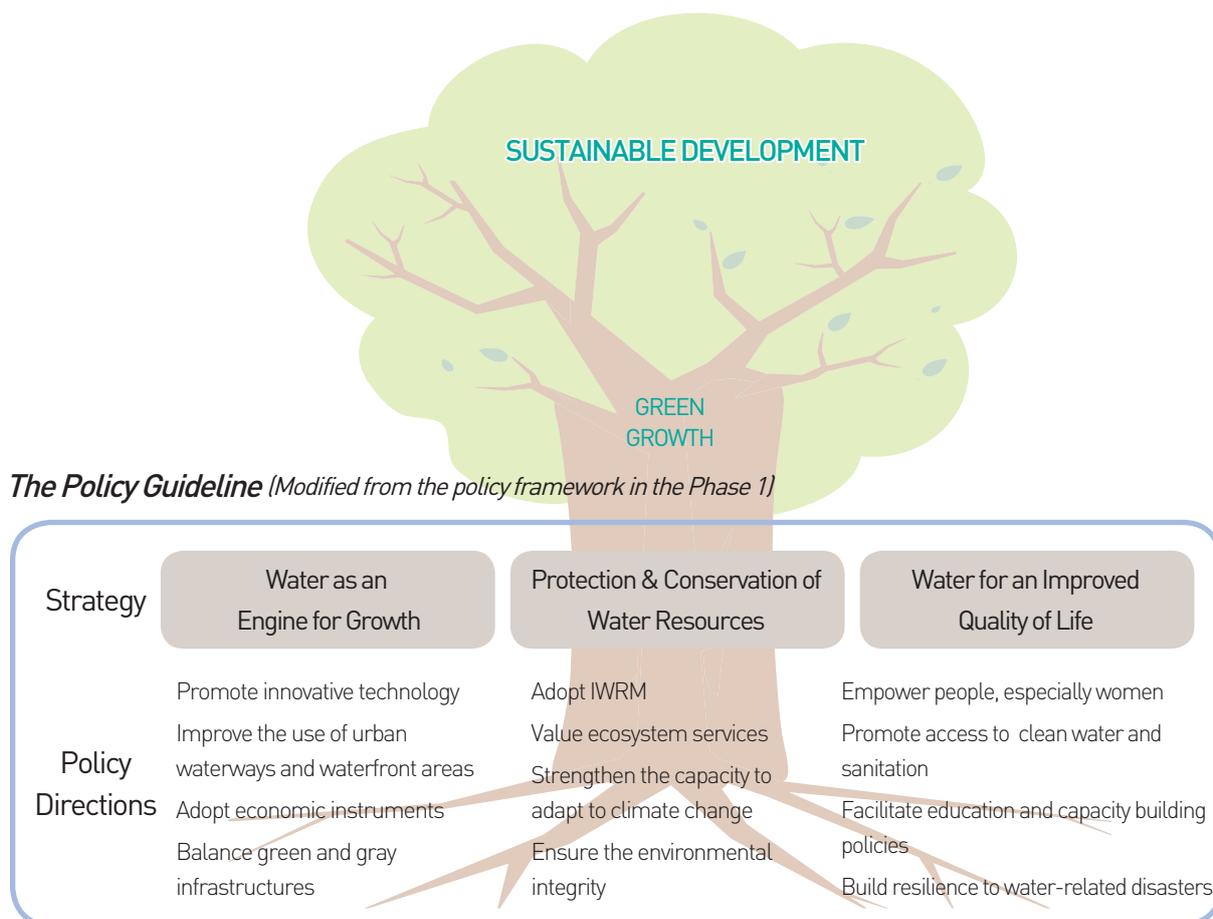


Figure 5-1. The Policy Guideline for Water and Green Growth (2015)

5.2 Policy Directions under the Policy Guideline

In this section we present some of the policy instruments and strategies that were derived from the analyses of case studies in all three phases of the Water and Green Growth Project. In Phase 1 of the Project, each strategy (Water as an Engine for Growth, Protection and Conservation of Water Resources, and Water for Improved Quality of Life) was devised with policy directions under strategy. After conducting in-depth case studies in Phases 2 and 3, some policy directions were revised and developed further. The policy guideline aims to provide decision makers, who are willing to achieve Water and Green Growth, with a tool that guides their policy making and implementation process.

ECONOMIC DIMENSION: WATER AS AN ENGINE FOR GROWTH

PROMOTE TECHNOLOGY TRANSFER AND INVEST IN INNOVATIVE TOOLS

- ▶ Ensure a balance between small-scale technologies and large-scale infrastructure that can result in optimal results
- ▶ Increase efficiency in water and energy technologies, such as adoption of smart water metering and water sensors in the smart water grid.
- ▶ Transfer knowledge and know-hows through information technology within a country and between countries.
- ▶ Consider local socio-economic and technological circumstances when determining the transfer of technology and select the most 'appropriate technology' for local conditions.
- ▶ Seek out traditional and indigenous technologies that protect the environment and water quality, even though they are not considered high-tech.
- ▶ Seek international financing sources to support the adoption of clean technologies in the water sector and explore possibilities for cooperation and collaboration in R&D for green technologies.

REVITALIZE AND IMPROVE THE USE OF URBAN WATERWAYS AND WATERFRONT AREAS

- ▶ Establish suitable policy and plans to clean urban waterways by controlling pollution, improving decentralized sewage and

collection systems, and using new green technologies for treating sewage, including energy saving and energy efficient technologies.

- ▶ Prepare and implement multi-use development plans along urban waterways, including parks, recreation facilities, planted areas, and commercial and residential zones.
- ▶ Discourage urban residents from living in or close to flood-prone areas and enhance storm water drainage and storage under a climate-resilient society program.
- ▶ Facilitate adoption of green transport such as barges, ferries, and boats on waterways for movement of goods and people.
- ▶ Improve waterfront areas by moving water polluting industries away, requiring water treatment by any enterprise on the waterfront and introducing cultural, entertainment and sporting venues where local residents can enjoy the benefits of green growth projects.
- ▶ Invite people to be involved in conserving protected zones in cities.

ADOPT A PACKAGE OF ECONOMIC INSTRUMENTS

- ▶ Establish incentives for recycling and reuse of water in agriculture, industries, and cities:
 - Promote the adoption of water saving appliances in households, industry and power generation through smart water technologies (demand management);
 - Establish regulations on recycling and reuse by industry, especially using various incentive systems;
- ▶ Adopt sound water tariff systems:
 - Introduce progressive tariff rates for water use, with low rates for basic consumption and increasing block rates for higher consumption in order to decrease wastage and encourage conservation;
 - Adopt the polluter pays principles for industry and user pays tariff systems in agriculture;
 - Ensure that tariff reforms reflect the real financial, resource and environmental costs of water services.
- ▶ Encourage public awareness of responsible water use through education programs and campaigns.
- ▶ Enhance economic efficiency of municipal water and sewerage facilities:
 - Provide adequate institutional settings to water and wastewater services providers to ensure higher efficiency and economic returns in water utilities;

- Introduce tariffs that reflect financial and environmental costs coupled with ensuring cost recovery for utilities;
- Encourage adoption of green technologies such as a smart water grid in order to reduce leakage and improve distribution systems;
- Create enabling environments for service providers to have easy access to credit on better terms and conditions, reducing reliance on public funds.
- ▶ Explore economic opportunities for industry, small-scale enterprises and employment.

BALANCE GREEN AND GRAY INFRASTRUCTURES AMONG COMPETING USES

- ▶ Promote green infrastructure projects such as infiltration, capture, protection of wetlands and other natural infrastructure, reuse and recycling of rainwater.
- ▶ Establish adequate and harmonized instruments, including policies, plans, and regulations at the national and local levels.
- ▶ Encourage local stakeholders to clean up local water bodies, protect ecosystems, and restore wildlife habitat and fisheries.
- ▶ Introduce integrated water and land management policies that include the river within urban development.
- ▶ Renovate gray infrastructure, e.g. old buildings and warehouses, and turn them into green infrastructure for commercial or cultural purposes.
- ▶ Introduce various financing measures to support the promotion of green infrastructure, e.g. inviting private investors to make investments in renovating gray infrastructure for public purposes.

ENVIRONMENTAL DIMENSION: PROTECTION AND CONSERVATION OF WATER RESOURCES

ADOPT RIVER BASIN MANAGEMENT PLANS USING INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) PRINCIPLES

- ▶ Engage national and local political leaders in supporting river basin and watershed management plans in order to secure political legitimacy and commitment for Water and Green Growth.

- ▶ Introduce various measures to reduce pollution, restore waterways, and enhance biodiversity in the basin.
- ▶ Establish a system in which responsible organizations undertake initial baseline assessments, gather reliable data, administer the program, and support local water managers through decision-support and monitoring systems. Such data and information include not only hydrological and environmental data but also socio-economic data that lead to appraisal of the progress of achieving Water and Green Growth.
- ▶ Strive to provide a forum where a variety of experts from different fields, economists, social scientists, engineers, and scientists communicate with each other to balance economic growth, environmental protection, and social development.
- ▶ Make sure that the principle of stakeholder participation is included in institutions at the national and local levels with regard to Water and Green Growth. In particular, local-level institutions should encourage local stakeholder participation in decision-making.
- ▶ Secure financial support from both public and private investors. Government funds from taxes and water tariffs can be supplemented by financing from the private sector or public-private partnerships.
- ▶ Ensure the balance between the benefits from natural river functions and the socio-economic benefits from hydropower, irrigation, and water supply to cities and other uses.

VALUE ECOSYSTEM SERVICES TO ENSURE THEIR CONSERVATION

- ▶ Adopt valuation instruments such as Payments for Environmental Services (PES) as a good reference to value environmental services for conservation.
- ▶ Consider small-scale projects first with the approach of a 'learning by doing' process when introducing PES.
- ▶ Provide reliable information to downstream water users about why they should contribute financially to the protection and restoration of ecosystem services by upstream landowners and managers.
- ▶ Identify beneficiaries from and suppliers of ecosystem services and convene representatives of each group who are able and willing to participate in discussions and negotiations on behalf of others.

- ▶ Ensure receipt of payments for services from the main water users, including industry, municipalities, and downstream communities, water and sewerage utilities, hydropower producers, mining and oil companies, and agricultural associations and cooperatives.
- ▶ Establish flexible policies to produce desired outcomes rather than being constrained by rigid formulas.
- ▶ Increase investment in rural livelihoods and green jobs to encourage green growth related to water environments.
- ▶ Make payments and incentives conditional on results – e.g. farmers and communities in watershed areas have to keep their share of the bargain.

STRENGTHEN THE CAPACITY TO ADAPT TO CLIMATE CHANGE

- ▶ Establish national and local plans, laws, and regulations for climate change adaptation
- ▶ Increase public funds to support research and data collection on climate change in relation to water resources management.
- ▶ Forge collaboration among various interests in mobilizing resources to restore invaluable ecological assets. Multilateral stakeholder dialogues among competing users are crucial.
- ▶ Provide numerous options for construction of green infrastructure to enhance water supply and water quality and to prevent natural disasters such as floods, in order to ensure continuous socio-economic development.
- ▶ Get watershed communities involved in protecting the water source and its ecosystem.

ENSURE THE ENVIRONMENTAL INTEGRITY OF THE ECOSYSTEM AND PROTECT BIODIVERSITY

- ▶ Prevent deterioration, enhance and restore bodies of surface water, achieve reasonable chemical and ecological status of such water bodies and reduce pollution from hazardous discharges from household, industrial, and commercial users.
- ▶ Protect the status of all bodies of groundwater, prevent the pollution and deterioration of groundwater, and keep a balance between groundwater abstraction and replenishment.
- ▶ Protect coastal zones from toxic run-off from surface water sources. Restoring river water quality improves seawater quality and protects the rich biodiversity of estuaries.
- ▶ Ensure preservation of endangered species (flora and fauna)

SOCIAL DIMENSION: WATER FOR AN IMPROVED QUALITY OF LIFE

EMPOWER PEOPLE, ESPECIALLY WOMEN, TO BETTER MANAGE WATER RESOURCES

- ▶ Establish a specific mechanism to promote stakeholder participation in Water and Green Growth projects prior to their launch.
- ▶ Introduce education and training programs for capacity building aimed at both women and men and strive for gender balance.
- ▶ Pay attention to establishment of participatory irrigation management through Water Users Associations and farmer cooperatives.
- ▶ Ensure that women, who in most places hold primary responsibility for water use and hygiene in the home, and who are responsible for caring for both the young and the old, are involved in decision-making so that the solutions proposed to them are sure to correspond to their needs.

PROMOTE ACCESS TO CLEAN DRINKING WATER AND SANITATION

- ▶ Ensure equal access to drinking water and sanitation services for the general public, especially the poor and the marginalized as a means to improve human health, livelihoods, gender equality and economic development.
- ▶ Engage and educate women and men in managing their water and sanitation facilities.
- ▶ In underserved areas, start with small-scale solutions such as rainwater harvesting, water reuse and recycling, water and sanitation for schools and public markets, communal sanitation facilities and kitchen and rooftop gardening.
- ▶ Protect workers and indigenous people in traditional sectors and facilitate their inclusion as stewards in protecting watershed through green infrastructure.

FACILITATE EDUCATION AND CAPACITY BUILDING POLICIES

- ▶ Introduce a series of educational and capacity building programs in order to:
 - Adapt workforce skills to the emerging green job market;
 - Facilitate investments in human resources development, especially in acquiring green technology and management skills;
 - Increase effectiveness and reduce the costs of green technologies.
- ▶ Focus on younger professionals who have the potential to become actively engaged in adopting and developing green technologies.

BUILD RESILIENCE TO COPE WITH WATER-RELATED DISASTERS

- ▶ Promote special policies and plans for enhancing the capacity of people to prepare for floods and respond to disaster and recovery in accordance with the Post-2015 UN Hyogo Framework Directive.
- ▶ Mainstream water-related disaster policies and plans, which should be incorporated into socio-economic development plans at the national and local levels.
- ▶ Educate women and men at different levels of society about how to cope with water-related disasters and to be first responders in moving people and animals to safety.
- ▶ Arrange sound financing mechanisms to support relevant policies, plans, and programs at times of disaster.
- ▶ Work with river basin communities and consult with traditional and indigenous groups to seek their knowledge for the best solutions for the construction of green infrastructure, such as terraces, planting native species along waterways and reforestation of protected areas.

5.3 The Policy Mix

The WGG Project Team has examined the set of institutions and policy instruments that address water and development challenges for achieving Water and Green Growth. Water is a means by which three pillars of sustainable development: economic efficiency, environmental sustainability, and social equity, can be achieved. Thus, green growth with water at its center can bring economic, environmental and social benefits of sustainable development. As water-related issues are cross-cutting, the challenges cannot be overcome by applying a single policy instrument. Water not only should be integrated into socio-economic development plans but also should be strategically managed in conjunction with other sectors. Thus, groups of institutions and policy instruments (state-driven, market-oriented, and community-centered), that were categorized according to their drivers and/or principles that influenced the changes, should be combined and implemented to address contextual challenges and to meet development needs that are unique to each country (e.g. political system, development progress, environmental awareness, etc.).

The policy guideline in the previous section (that encompasses strategies and policy directions) is a more general and comprehensive recommended set of institutions and policy instruments that can satisfy the three pillars of sustainable development and enhance the performance of Water and Green Growth. Ideally, a country regardless of its contexts and characteristics should consider adopting many of the options in the policy guideline. However, this certainly is not realistic in practice. Instead, the policy mix provides a frame within which policy makers can decide on a combination of institutions and policy instruments they will focus on to implement Water and Green Growth. The policy mix allows them to select and tailor from institutions and policy instruments within the policy guideline, according to each country's contexts and development interests. This will be especially useful for developing countries that often face difficulties in developing and implementing appropriate policies because of institutional and economic constraints along with rather standardized development suggestions imposed by developed countries. Hence, the policy mix can result in higher and more effective performance. "Tailoring" with the policy mix will be the key to successful Water and Green Growth initiatives.

The case studies confirm that different combinations of state-driven, market-oriented, and community-centered institutions and policy instruments have been widely adopted in many countries, according to different circumstances and requirements, on the pathway to achieve green growth with water management at its core. The three types of policy mixes⁵⁾ are: State-driven and Market-oriented (SM); Market-oriented and Community-centered (MC); and State-driven and Community-centered (SC). These have been extracted from the analyses of the 11 case studies.

Types of Institutional Tracks

It is important to have a good understanding of the strengths and weaknesses of typical policies for the application of a policy mix frame. An adequate use of a policy mix paves the way for policy makers to opt for the solutions on how to reduce the weaknesses and maximize the strengths of different institutions, actors and contexts by pursuing tailored combinations among them. Table 5-1 displays the basic characteristics of institutions coupled with the strengths and the weaknesses of three types of institutional approaches (state-driven, market-oriented, and community-driven).

The state-driven institutions is led by the main body of policy and decision makers, usually the state. The state-driven institutions and policy instruments can provide better procurement and implementation of financing development projects in a relatively short time. Since policies are planned and implemented with the top-down approach, conflicts may often occur among the stakeholders in failing to accommodate and adjust their different needs and interests. Cases related to the state-driven institutions are often associated with

5) These types of policy mixes does not necessarily reflect all available mix options. According to context, it is possible to develop and adopt wide range of policy mix types.

Table 5-1. Institutional Tracks, Strengths, and Weaknesses

| Types of institutional tracks | Characteristics | Strengths | Weaknesses |
|-------------------------------|--|--|--|
| State-driven | <ul style="list-style-type: none"> Strong role of government Often top-down approach | <ul style="list-style-type: none"> Strong enforcement Easier budget planning and execution | <ul style="list-style-type: none"> Potential conflicts among stakeholders Performance-oriented Heavy bureaucracy |
| Market-oriented | <ul style="list-style-type: none"> Market mechanism Economic instruments Private sector participation | <ul style="list-style-type: none"> Demand side management Efficient operation and management Procurement of investments and funds | <ul style="list-style-type: none"> Environmental concerns secondary to economic benefits Social exclusion and unequal distribution of benefits |
| Community-centered | <ul style="list-style-type: none"> Stakeholder participation Bottom-up approach | <ul style="list-style-type: none"> Opportunity to resolve conflicts. Collective support | <ul style="list-style-type: none"> Lack of financing Time consuming to coordinate |

social conflicts between diverse stakeholders due to the lack of consensus. Such results trigger postponement and alteration of project plans, which entails further economic and political costs. They can be improved if complemented with a governance-based decision-making and implementation processes, as illustrated in the case studies. It should also be noted that other types of institutional tracks normally require some sort of national or local government intervention to be successful.

The market-oriented institutional track comprises policy instruments based on the market principles and mechanisms. The laws of supply and demand is employed along with policy attempts to solve and internalize externalities of public goods. Using economic instruments such as water pricing and payment for environmental services (PES) can help to change consumption patterns. Sometimes, such policy instruments are criticized because of their characteristic of primarily seeking economic benefits when dealing with what people perceive as public goods.

There is a growing recognition that water is a human right, and this notion is strongly supported by groups who are deeply concerned with ensuring basic access to water and sanitation that are crucial for survival. Such advocates are often ideologically opposed to making profits from the privatization of water and sanitation services. Nevertheless, private sector participation has increasingly been one of the major trends in the water sector, because it does improve access, sustainability of operations, and quality of services in some situations. The notion of “water as an economic good”, albeit problematic, is gaining more attention because of the need to secure an adequate level of funding and to ensure efficiency in operation and maintenance of water and sanitation services.

The market-oriented institutional track can be complemented with the government’s effort to enhance effectiveness and overcome its shortcomings such as an increase of water use efficiency through demand management and channeling public funds for sustainable water supply and management. For instance, when the level of water tariffs is below production costs, financial sustainability for water service providers is not achieved, thereby resulting in the need to receive subsidies from the government’s budget.

The community-centered institutional track is one in which various stakeholders associated with projects should be consulted and be involved in decision making. There should be transparency in access to adequate and cost-free information and encouragement of stakeholder participation. Within such an approach, a platform is created to discuss and reflect various needs and interests of a wide range of stakeholders. Even though it takes time to reach a consensus on a policy, it may bring about a higher level of satisfaction of stakeholders and lower social and political costs by increasing stability and ensuring long-term success of the policy or project.

Clearly, there are strong and weak points in the three institutional tracks. To address water-related challenges in all economic, environmental, and social dimensions, state-driven, market-oriented and community-centered institutional tracks should be selected and tailored to a state’s context and development objectives. In the following section, the three types of policy mixes are examined.

Types of Policy Mix

In general, water policies in many countries consist of a wide range of institutions and policy instruments. Most countries introduce various sets of policy implementation measures in order to meet overall international and national development goals and to solve the country's water-related challenges. As mentioned formerly, these institutions and policy instruments have been categorized into three types of institutional tracks based on principles or/and drivers that largely influence their changes. The policy mix combines more than one institutional track to meet the needs of a specific country. The policy mix in this study is defined as "a set of institutions and policy instruments that are set up and implemented as a function of complex socio-political and economic contexts related to water resources".

The WGG Project Team has classified the types of policy mix based on the results of the case studies, according to the institutional tracks that seem to stand out prominently in terms of effectiveness in accomplishing Water and Green Growth objectives. In doing so, the report advises policy makers to first decide on a mix of institution types (deciding on proportion of each type of institutional track) that frames which institutions and policy instruments to adopt and implement, to achieve green growth through the water sector. The policy mix is an opportunity to frame the scope of institutions and policy instruments depending on specific contexts and needs of a country. The analyses found that there has been a wide range of policy mixes adopted, but the WGG Project Team has focused on the three main types of policy mixes based on the evaluation of outcomes from the 11 case studies.

Figures 5-2, 5-3, and 5-4 illustrate three types of policy mix as described above. The effectiveness of each policy mix is evaluated with the average values found for economic, environment, and social performances. Table 5-2 below shows how the 11 case studies is classified into three types of policy mix.

Table 5-2. Three Types of Policy Mixes

| Policy Mix | State-driven + Market-oriented (SM) | Market-oriented + Community-centered (MC) | State-driven + Community-centered (SC) |
|------------|---|--|---|
| WGG Case | China (Pudong Shanghai); Brazil; Turkey (Golden Horn); and Egypt | Australia (Murray-Darling Basin); Nepal; and Ecuador | India (Gujarat); Republic of Korea (Lake Sihwa); Republic of Korea (Taehwa River); and Spain (Ebro River Basin); |

The State-driven plus Market-oriented Policy Mix (SM Mix) is the most common among the 11 case studies. This policy mix has been effective in 4 case studies out of 11 in China (Pudong Shanghai), Brazil, Turkey (Golden-Horn), and Egypt. As seen in Figure 5-2, 77% of the respondents among the four case studies responded that state-driven or market-oriented institutions are effective. According to the results, the levels of economic, environmental, and social performances achieved were relatively high compared to other policy mixes. The strong leadership of the state and effective market-oriented instruments created synergies for sustainable development. Therefore, the State-driven and Market-oriented Policy Mix (SM Mix) showed a positive impact on the institutional effectiveness towards Water and Green Growth.

For this type of policy mix, the applicability is high in developing countries that are strongly influenced by the government that implements state-driven policies. Market-oriented instruments are introduced to complement any weaknesses, such as government failure and bureaucratic inefficiency, in the state-driven policy. To use the SM Mix more effectively, stakeholder participation should be considered and encouraged from the initial stage of planning. Otherwise, conflicts may arise between governments and stakeholders with different perspectives on development, thereby leading to a delay of the project. In addition, market mechanisms should deal with not only pricing, but also the scope of the participation of the private sector. The involvement of the private sector is also encouraged to ensure financing sources which can speed up the implementation of the project and invite more investments, although the private sector should not seek disproportionate economic benefits.

· Relevant cases: China (Pudong, Shanghai), Brazil, Turkey (Golden Horn), and Egypt

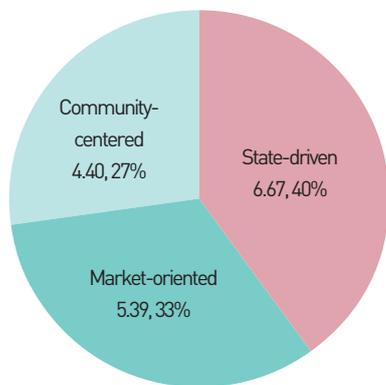


Figure 5-2. Effectiveness of Institutions with Four Cases with SM Mix

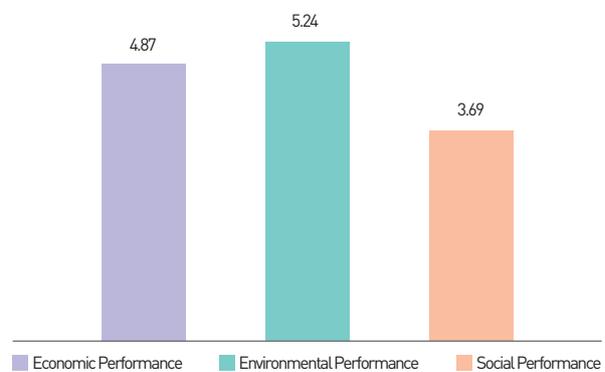


Figure 5-3. Measuring Performance in the Four Case with SM Mix

The Market-oriented plus Community-centered Policy Mix (MC Mix) is combined with market-oriented policy instruments and community-centered governance mechanisms. Among the case studies, Australia, Ecuador, and Nepal have deployed the MC Mix. As seen in Figure 5-4, 75% of the respondents of the three case studies responded market-oriented or community-centered institutions are effective. However, the performance of the MC Mix as measured in the analysis came out relatively low compared to other policy mixes. The low performance of the MC Mix can be attributed to two aspects: lack of political leadership for enforcement of plans and policies and/or its use in the countries that already have achieved an advanced level of development goals (e.g. Australia). Commonly, stable political and economic situations were identified as pre-conditions for effective implementation of market-oriented instruments and stakeholder participation.

To complement the MC Policy Mix, the state needs time to persuade stakeholders in changing their unsustainable consumption patterns. Raising environmental awareness can be a tool to encourage stakeholders to support implementation of economic instruments. As mentioned above, in the MC Mix, it is important to consider political and economic conditions. In politically unstable countries like Nepal, state-driven policy instruments are often lacking or implemented in an inappropriate way. The private sector and the community can replace or complement operational and technical capacity of political authorities. Market-oriented institutions may function well to complement weak political institutions. On the other hand, the Commonwealth government in Australia articulated institutional arrangements at the basin level and set a legal framework, setting clear boundaries of rights and responsibilities among stakeholders in the Murray Darling River Basin. Political stability and arranged institutional settings enabled the Murray-Darling River Basin to adjust different interests among the competing water users.

· Relevant cases: Australia (Murray-Darling Basin); Nepal; and Ecuador

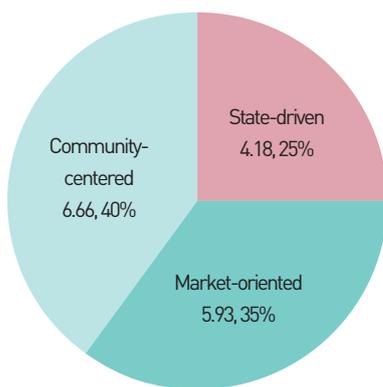


Figure 5-4. Effectiveness of Institutions in the Three Cases with MC Mix

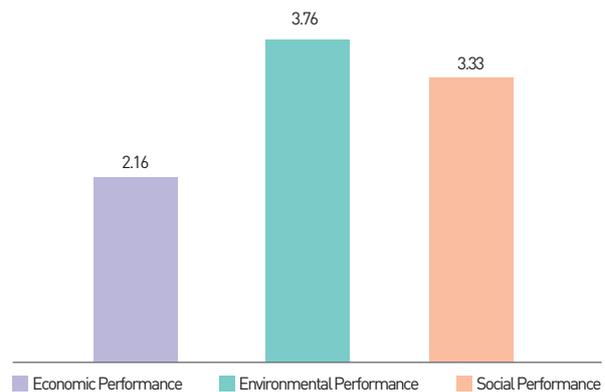


Figure 5-5. Measuring Performance in the Three Cases with MC Mix

The State-driven plus Community-centered Policy Mix (SC Mix) combines top-down approach by the central government with decentralized institutions and policy instruments. Four case studies fall under this category: India (Gujarat); the two Korean case studies (Sihwa and Taehwa); and Spain (the Ebro Basin). The performance of the SC Mix is found most outstanding on environmental dimension.

As seen in Figure 5-6, respondents of the four case studies responded state-driven or community-centered institutions are effective. To implement the SC Mix effectively, a coordination mechanism is necessary to resolve conflicts. As key enablers and implementers, the government and stakeholders can embrace different points of view on development plans. To harmonize the different opinions of both sides, regular meetings, with access to transparent and adequate information, and clear divisions of roles are required. Since the coordination process can take longer, a time frame should be carefully established. To implement a long-term Water and Green Growth Project, the government should provide financial support such as subsidies. However, there might be financial constraints to continuing the projects. Since ensuring financing will be one of the key issues to facilitating the SC Mix, encouraging private sectors is required to mobilize financing sources.

· Relevant case: India (Gujarat); Republic of Korea (Lake Sihwa and Taehwa River); Spain (Ebro River Basin)

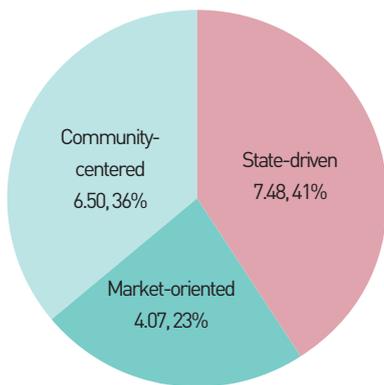


Figure 5-6. Effectiveness of Institutions in Four Cases with SC Mix

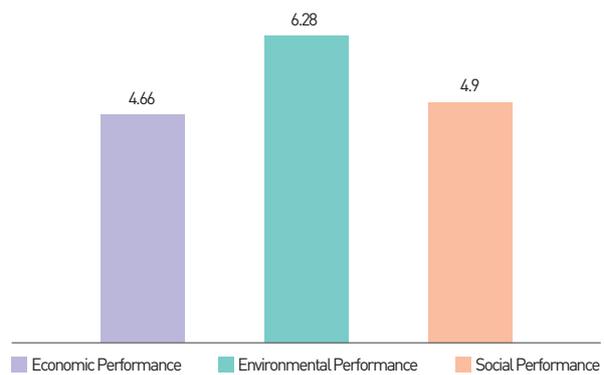


Figure 5-7. Measuring Performance in the Four Cases with SC Mix

5.4. The Policy Implementation Roadmap

The WGG Project aims to provide a set of policy guideline to policy makers for using water management as a means to achieving green growth. In this regard, the policy implementation roadmap provides a process for countries who are interested in adopting water management strategies that will lead to green growth. The WGG Project suggests several steps that can be taken to lead to successful Water and Green Growth outcomes, all of which entail a balance between the three pillars of sustainable development: economic growth, environmental protection, and social well-being.

Step 1. Diagnosis

Identifying key challenges each country is facing can be a starting point of implementing green growth strategies. It is recommended for policy makers to identify current situations and limitations. Policy makers are advised to identify major water resources problems and limitations, in order to determine policy instruments and implement them appropriately. For example, when water shortage is a problem in a region, policy makers should explore whether it is a permanent issue or not, and whether it is a national or regional level problem or not. Determining the scope of the issue can be a starting point for seeking Water and Green Growth solutions.

Step 2. Target Setting

It is important to set targets for the project, which will serve as a guide to achieving green growth. At this stage, countries will set a specific goal and envisage related targets. In addition, it is important to recognize each country's capacities, such as financial and human resources, to successfully execute the project. Identifying specific actors who are going to implement policies should be carried out at this stage.

Step 3. Selecting a Policy Mix

From the diagnosis and target setting, decisions should be made based on which type of policy mix is the most appropriate. At this stage, policy makers should consider how to set the best pathway to achieve the overarching economic, environmental, and social objectives.

However, each country will have different starting points in adopting Water and Green Growth policies due to different national circumstances. To find the appropriate policy instruments for each country, challenges and circumstances should be diagnosed at the initial stage (Step 1). Bearing in mind what challenges they are facing, policy makers need to set specific targets which are feasible to realize (Step 2). Then a type of policy mix will be selected (Step 3). Attaining desirable outcomes in economic, environment and social dimensions requires an appropriate mix of policies and concrete policy instruments that complement each another.

Step 4. Implementing Policy Instruments

Policy instruments should be selected in the process of decision making. They will be determined in combination with properly set targets and an implementation mix. In this report, policy instruments encompass instruments such as integrated water resources planning, budget support, cost recovery, tradable water permits and PES, innovative technology, capacity building, stakeholder participation, and promotion of private sector participation.

Figure 5-8 illustrates a 4-step process for policy makers to consider in implementing their country's Water and Green Growth policies and strategies.

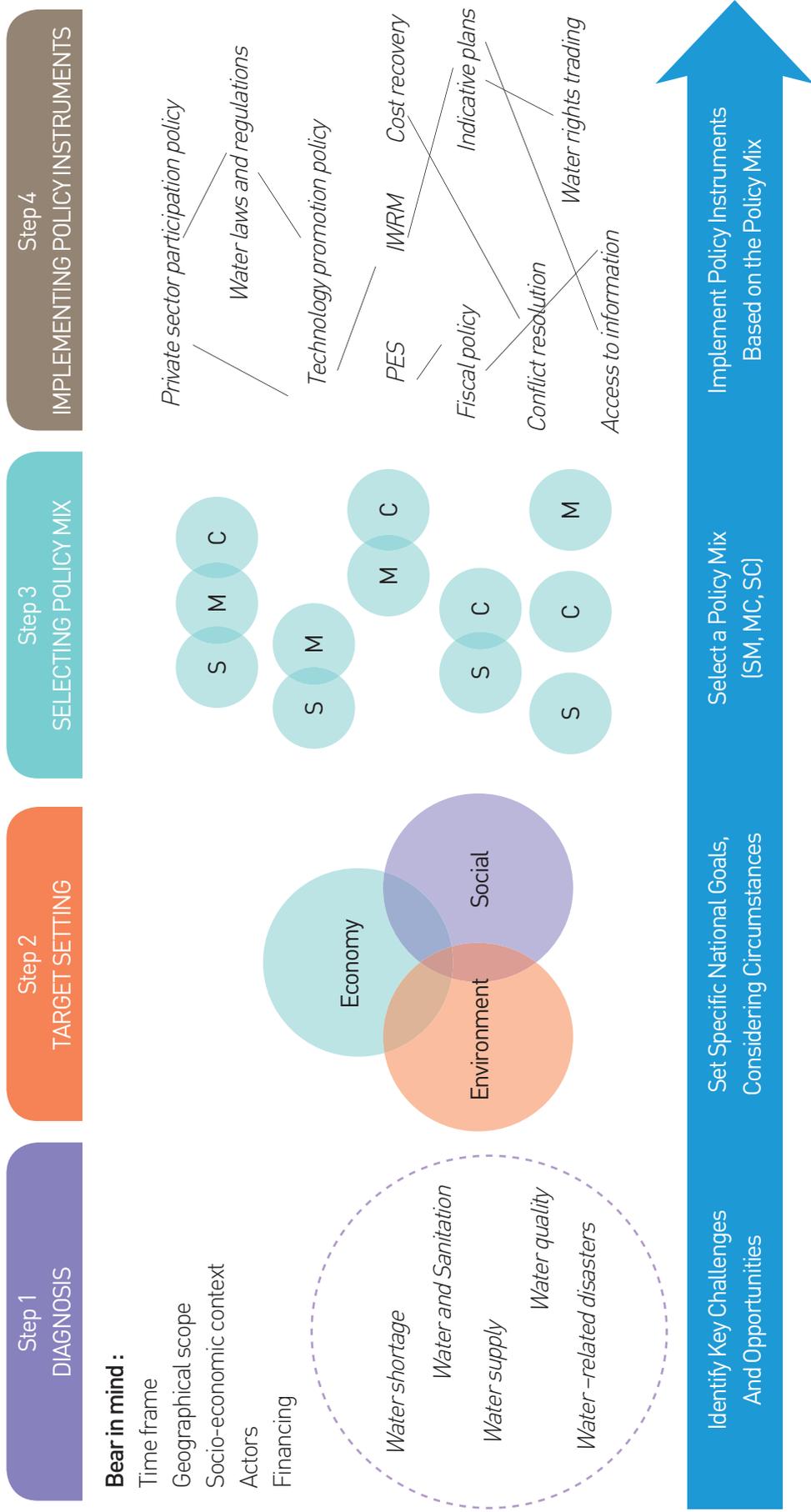


Figure 5-8. The Policy Implementation Roadmap

To select policy instruments, WGG Team provide the checklist and flow chart. Box 5-1 provides instructions for filling out the checklist in Table 5-3 and flowchart in Figure 5-9. These tools are a starting point for policy makers to identify the steps to be taken from planning to implementation and the policy instruments that will be most effective in a given situation.

In the checklist, four policy instruments in each institution are identified as the most effective instruments.

- ▶ State-driven: Balanced administrative layers and functions, well-organized indicative plans, laws and regulations, and fiscal policy;
- ▶ Market-oriented: Private sector promotion policy, economic instruments (e.g. PES), and water rights trading, and PPPs;
- ▶ Community-centered: Integrated approach, stakeholder participation, decentralization, and conflict resolution & coordination mechanisms.

The different range of scores depends on relative importance. For example, among the policy instruments, S-1, S-2, M-1, C-1 and C-2 have been found to produce relatively positive impacts on Water and Green Growth outcomes.

For better understanding for policy makers, two examples of assessments on institutions and policy instruments are presented; the Lake Sihwa Water Quality Improvement Project and Ecuador Water Fund Mechanisms for Watershed Protection.

Box 5-1. Assessment of Institutions and Policies: Instructions for Filling Table 5-3

1. Tick all relevant boxes in Table 5-3 that pertain to policy instruments in your country or region.
2. Sum up the score for each policy instrument.
3. Go to the flow chart (Figure 5-9). If the score of the state-driven policy is higher than 3 points, follow the red arrow to the market-oriented box. If not, follow the blue arrow. Next, if the score of market-oriented is higher than 3, follow the red arrow to community-centered. If not, follow the blue arrow. The same procedure will be conducted for the last stage. At this stage, you can see which policy mix type is applicable to your country at that moment in time.

Table 5-3. Checklist for Assessing Institutions and Policy Instruments by Country (or by Project)

| Institution Types | | Policy Instruments | Score ⁶⁾ | Tick |
|--------------------|-----|---|---------------------|------|
| State-driven | S-1 | Balanced administrative layers and functions | 2 | |
| | S-2 | Well-organized indicative plans | 2 | |
| | S-3 | Water laws and regulations | 1 | |
| | S-4 | Fiscal policy (subsidies and taxes) | 1 | |
| | | Total score | | |
| Market-oriented | M-1 | Private sector promotion policy | 2 | |
| | M-2 | Economic instruments | 1 | |
| | M-3 | Water rights trading | 1 | |
| | M-4 | Public-private partnerships (PPPs) | 1 | |
| | | Total score | | |
| Community-centered | C-1 | Integrated approach | 2 | |
| | C-2 | Stakeholder participation | 2 | |
| | C-3 | State policies favor decentralization | 1 | |
| | C-4 | Conflict resolution & coordination mechanisms | 1 | |
| | | Total score | | |

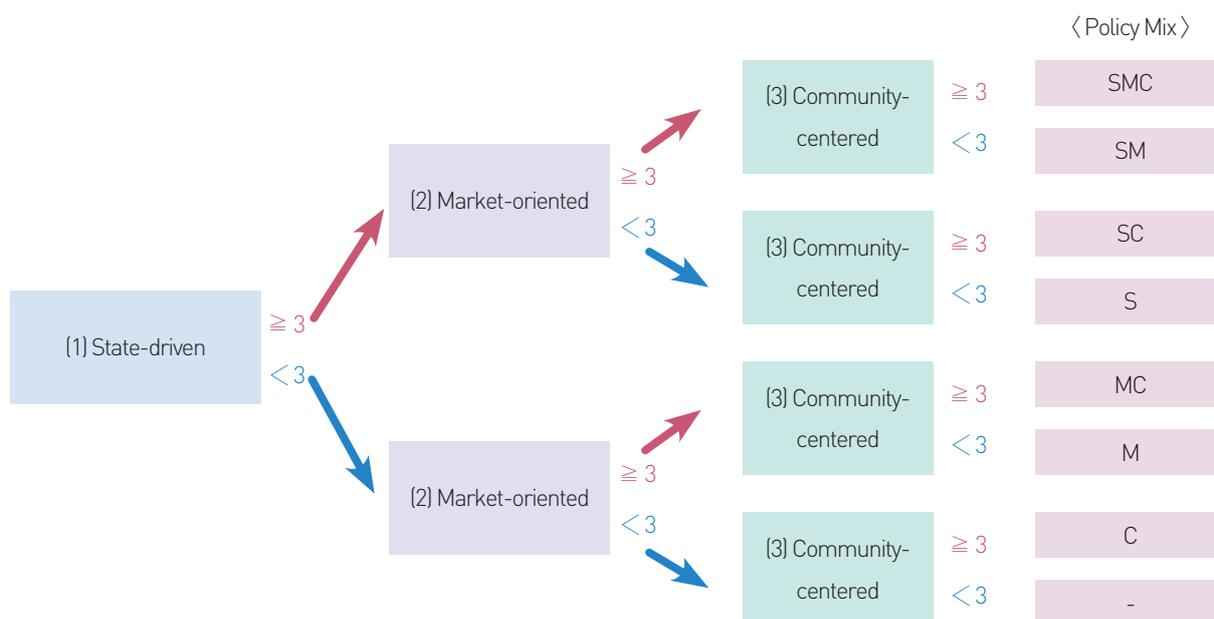


Figure 5-9. Flow Chart for Assessing Appropriate Policy Mix

6) The range of scores (from 1 to 2) is based on the results of quantitative analyses. The higher the score, the more effective policy instruments.

Table 5-4. Examples of Institutional and Policy Assessment on Lake Sihwa in Korea and Ecuador

| Institution Types | | Policy Instruments | Score | Tick | |
|--------------------|-----|---|-------|-------|---------|
| | | | | Sihwa | Ecuador |
| State-driven | S-1 | Balanced administrative layers and functions | 2 | ✓ | |
| | S-2 | Well-organized indicative plans | 2 | ✓ | |
| | S-3 | Water law and regulations | 1 | ✓ | ✓ |
| | S-4 | Fiscal policy (subsidies and taxes) | 1 | | |
| | | Total score | | 5 | 1 |
| Market-oriented | M-1 | Private sector promotion policy | 2 | | ✓ |
| | M-2 | Economic instruments | 1 | ✓ | ✓ |
| | M-3 | Water rights trading | 1 | | |
| | M-4 | Public private partnership PPPs | 1 | | ✓ |
| | | Total score | | 1 | 4 |
| Community-centered | C-1 | Integrated approach | 2 | | ✓ |
| | C-2 | Stakeholder participation | 2 | ✓ | ✓ |
| | C-3 | State policies favor decentralization | 1 | | |
| | C-4 | Conflict resolution & coordination mechanisms | 1 | ✓ | ✓ |
| | | Total score | | 3 | 5 |
| Type of policy mix | | | | SC | MC |

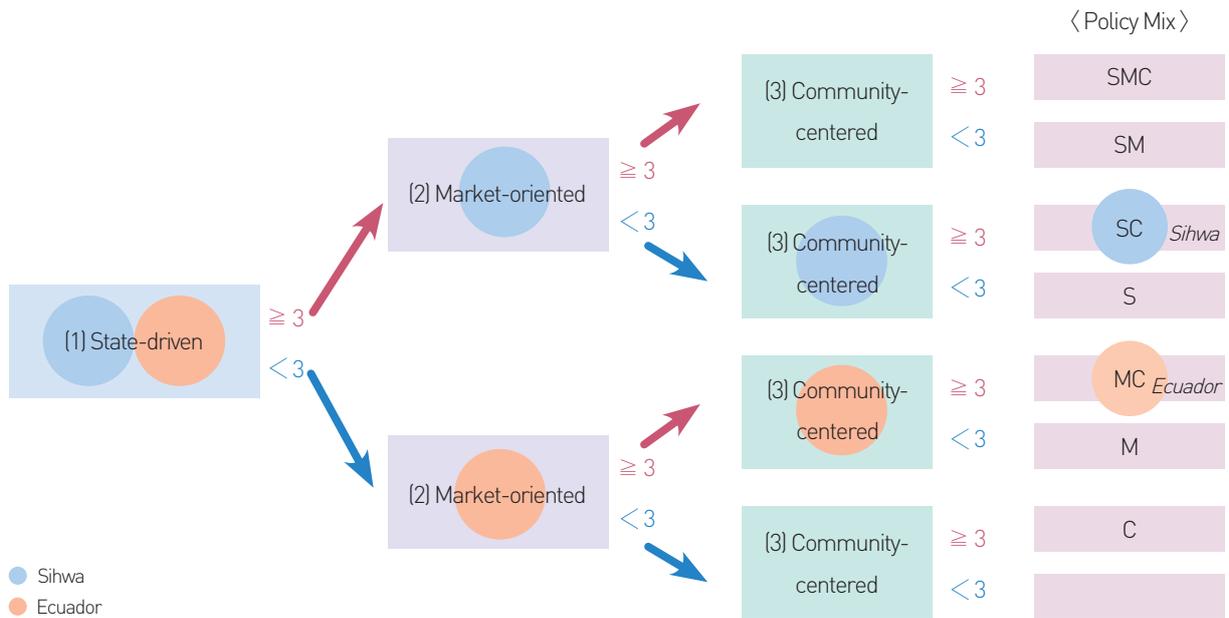


Figure 5-10. Flow Chart for Examples, from Lake Sihwa in Korea and Ecuador

Box 5-2. Example 1: The Lake Sihwa Water Quality Improvement Project, Republic of Korea

The Lake Sihwa Project started with the construction of a seawall across a bay. After the completion of the seawall, the water quality in the lake began to deteriorate. With the degradation of Korea's water environment and the rise in society's interest in protection of the ecosystem, the central government of Korea decided to organize indicative plans (S-2) to improve water quality. The political stability of Korea and relative lack of corruption has had a positive impact on implementing state-driven policies. The government applied water quality regulations to the Sihwa district and to local companies that had exceeded their pollution and discharge quotas (S-3, M-2). In addition, relevant and diverse stakeholders have been included in the policy decision-making process, and coordination between relevant ministries has functioned well (S-1). In terms of community-centered policy, many stakeholders were involved in the Sihwa District Sustainable Development Committee (SDSDC), which held over 250 meetings to resolve many conflicts and differences in opinion between civil society and the government, resulting in mutually satisfactory policies (C-2, C-4).

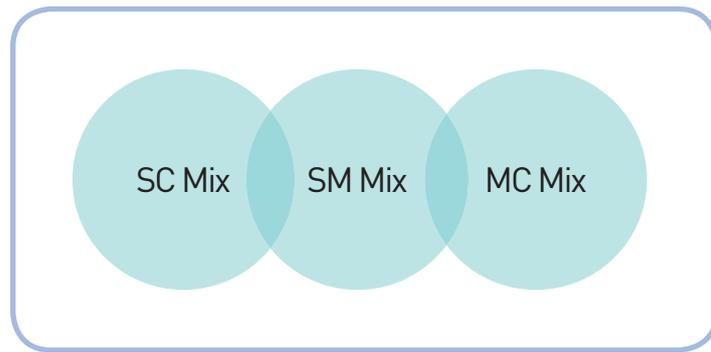
▶▶▶ Therefore, according to the checklist (Table 5-4) and flow chart (Figure 5-10), the Lake Sihwa case appears to be an example of an SC Policy Mix.

Box 5-3. Example 2: Ecuador: Water Fund Mechanisms for Watershed Protection

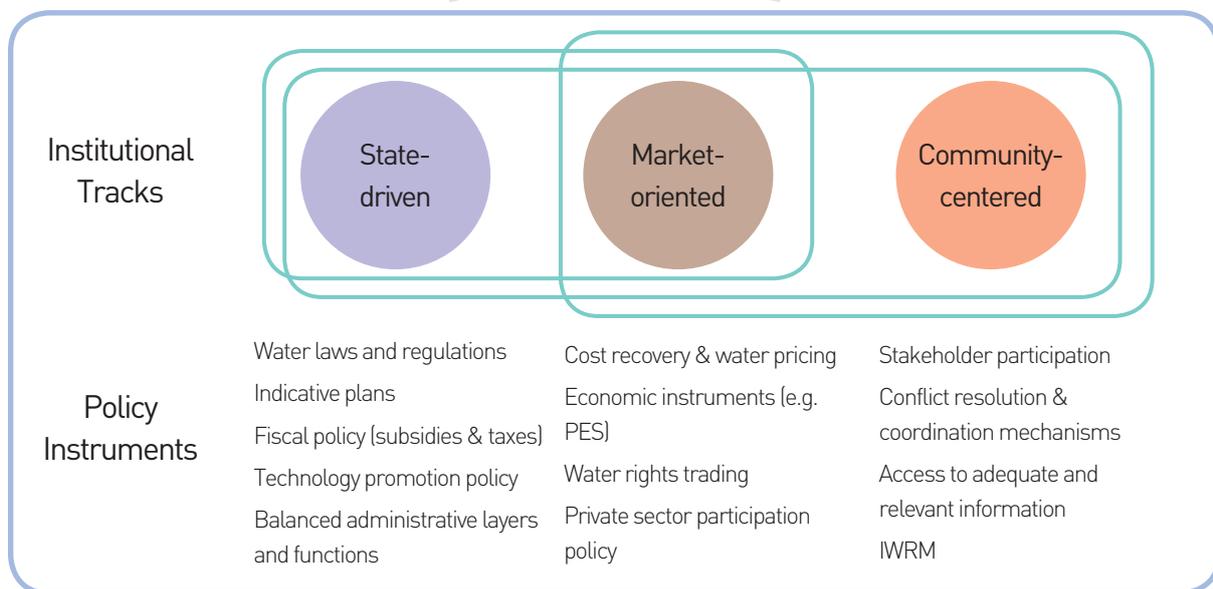
Ecuador is a country with relatively abundant water resources, four times more than the world average per capita. However, Ecuador is suffering from uneven distribution and contamination of water resources. Many of the big industries pay small fees for water use, monopolize water resources, and ignore existing laws. Small- and large-scale metal mining also cause disastrous impacts on the environment. To address the problems, Ecuador established water fund mechanisms to compensate environmental services such as protecting and supplying freshwater and providing biodiversity-related benefits. The water funds are based on payment for environmental services (PES) principles and are a means of mobilizing long-term trust funds (M-2, S-4). A public-private partnerships (PPPs) of water users determined how to invest in conservation activities in priority areas (M-4). Water funds gave incentives for private business and encouraged non-state stakeholders to participate (M-1). Plus, the Constitution includes mandates to protect biodiversity, mitigate climate change and regulate environmental services (S-3). With these mandates, the government also established a clear framework for water resources as a public good and basin human right. It provided legal ground to protect water resources. In addition, community-centered policies have been the most effective in implementation of water funds. The communities (many of them indigenous communities) that have been badly affected by poor management of water resources have been encouraged to participate in decision making at all stages, from its design to implementation (C-1). Sustainable financing mechanisms and stakeholder participation resulted in the success of the project (C-2, C-4).

▶▶▶ Therefore, according to the checklist (Table 5-4) and flow chart (Figure 5-10), the Ecuador case appears to be an example of an MC Policy Mix.

The Policy Mix



The Policy Roadmap
:To select an appropriate Policy Mix



The Policy Guideline (Modified from the policy framework in the Phase 1)

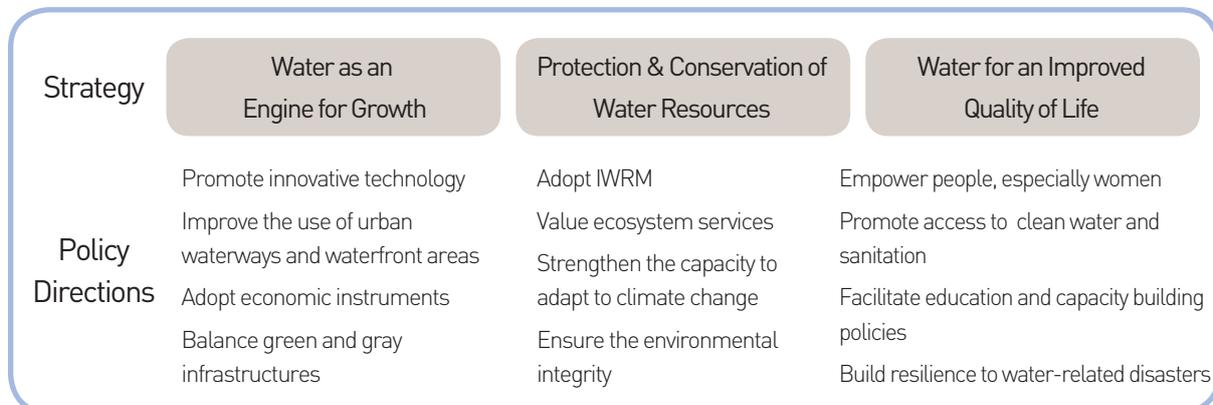


Figure 5-11. Overview of the Water and Green Growth Research

Key Messages

- ▶ Water is a vector through which green growth can occur.
- ▶ There is no one-size-fits-all strategy.
- ▶ A holistic approach to encompass three pillars of sustainable development is essential.
- ▶ Strong political leadership and commitment are essential.
- ▶ Indicative planning tools can be used by governments or basin organizations to promote holistic economic and social development through sustainable management of water resources and maintenance of related infrastructure to improve ecosystems.
- ▶ A clear legal framework supports Water and Green Growth projects in terms of consistency and continuity.
- ▶ Better coordination, with clearly defined responsibilities among actors, is needed for improved water management.
- ▶ Policies that support innovation and technology and foster R&D investment can improve water management.
- ▶ Increased investment dedicated to developing sustainable water services and infrastructure will yield high economic, environmental, and social returns.
- ▶ Economic instruments can be used as effective measures to safeguard environmental sustainability.
- ▶ Well-defined water rights for both surface and groundwater are crucial to effective water management.
- ▶ Stakeholder participation is valuable for reflecting the community interest, building support, and for conserving and protecting water resources.
- ▶ Educational programs and capacity building can increase environmental awareness and increase functional effectiveness of overall water resources governance.
- ▶ Enhanced water and data information can provide essential decision support for effective water management.





CHAPTER 6

CONCLUSION AND NEXT STEPS

This chapter presents a brief summary of the report, provides key messages, and discusses the next steps for achieving Water and Green Growth objectives. The report will guide policy makers with practical policy suggestions for facing the challenges in reaching green growth.

6.1 Summary

Water and Green Growth is a timely paradigm that is based on the idea of sustainable development. Policy makers have welcomed this initiative in order to strike the balance among economic growth, environmental protection, and social development. This approach is evolving and is flexible enough to be applied to different cases depending on political, socio-economic, and environmental circumstances.

This report is the outcome of the Water and Green Growth Project that was initiated jointly by the Government of the Republic of Korea (then the Ministry of Land, Transport and Maritime Affairs and now the Ministry of Land, Infrastructure and Transport, the Presidential Commission on Green Growth, and K-Water) and the World Water Council. Over the four years, a number of individuals and organizations have been involved in this unique policy research effort. The research presents the conceptualization of Water and Green Growth and the analytical framework on how to evaluate relevant case studies with a special emphasis on institutions and policy instruments coupled with a series of policy suggestions.

The analysis is based on a compilation of international case studies of Water and Green Growth - 26 case studies from Phase 1 and 11 case studies from Phases 2 and 3. The rich variety of case studies has served as a good foundation to develop the policy guideline to support policy makers at the local, national, and regional levels in both developing and developed countries. The analytical framework has developed through numerous discussions between experts in various fields and now encompasses strategic, institutional, and evidence-based approaches. The study provides a policy guideline and a policy mix, a guide on ways to implement policy instruments, and policy implementation roadmap as practical tools.

Chapter 2 has shed light on global trends regarding Water and Green Growth, including common perceptions of international organizations on the green paradigm, emphasizing the role of water in achieving green growth, discussing the significance of various ideas such as the Green Economy (UNEP), Inclusive Growth (World Bank), and Green Growth (OECD). The concept of Water and Green Growth provides practical approaches to solve water-related challenges and to foster broader economic development whilst ensuring environmental protection and social progress, which are the three pillars of sustainable development.

Chapter 2 also presents an analytical framework for assessing Water and Green Growth projects. The framework has been adopted and developed from the Institutional Decomposition and Analysis (IDA) Framework. This serves as a tool to classify water institutions, consisting of water law, water policy, and water organizations, and appraise the extent to which water institutions have evolved and changed in interaction with endogenous and exogenous factors. The study has revised the IDA Framework with the recognition of contributions from non-state actor to water policy making and implementation. Various policy approaches and instruments were identified that were influenced by diverse actors. These were divided into state-driven, market-oriented and community-centered approaches. This demonstrates a gradual shift in the architecture for water policy-making and implementation, towards more proactivity of non-state actors, such as private companies and civil society groups.

Chapter 3 describes the methodology used for identifying the diverse array of policy options that contribute to Water and Green Growth. Also, the chapter illustrates various policy instruments that have been adopted in case studies. Chapter 4 presents the results of the analysis of 11 case studies from 10 different countries. These cases reflect different levels (e.g. project level, local level, regional level, and country level) in order to understand the applicability of the concept in different contexts. Water-related challenges in each case were identified together with an assessment of policy implementation and performance indicators through quantitative and qualitative analyses. International and local consultants were interviewed to reflect their experiences and critical views on Water and Green Growth-related projects.

Within the context of the overall analytical framework, the case studies have been categorized based on different institutional changes into state-driven, market-based, and community-centered. A brief summary of the 11 case studies is presented in Chapter 4 that shows water policy instruments that fall under the three institutional change tracks. The policy implications and lessons learned derived from the full version of the case studies are available in an accompanying memory stick.

The correlation between institutions, exogenous factors, endogenous factors, and performance were thoroughly evaluated. Specific and general policy implications were extracted from each case. Through these analyses, the Water and Green Growth Project has explored the pivotal role of water for economic growth,

environmental protection, and social development. Water and Green Growth, as a development strategy, proves to be applicable worldwide and can be especially valuable to developing countries as a pathway to achieve sustainable development in an accelerated way. Under the strategy, its institutions and policy instruments can be flexibly adjusted to meet different development needs and objectives in accordance with each country's context. Several key messages have been extracted from the analysis of the case studies as follows:

Key Messages

- ▶ Water is a vector through which green growth can occur.
- ▶ There is no one-size-fits-all strategy.
- ▶ A holistic approach to encompass three pillars of sustainable development is essential.
- ▶ Strong political leadership and commitment are essential.
- ▶ Indicative planning tools can be used by governments or basin organizations to promote holistic economic and social development through sustainable management of water resources and maintenance of related infrastructure to improve ecosystems.
- ▶ A clear legal framework supports Water and Green Growth projects in terms of consistency and continuity.
- ▶ Better coordination, with clearly defined responsibilities among actors, is needed for improved water management.
- ▶ Policies that support innovation and technology and foster R&D investment can improve water management.
- ▶ Increased investment dedicated to developing sustainable water services and infrastructure will yield high economic, environmental, and social returns.
- ▶ Economic instruments can be used as effective measures to safeguard environmental sustainability.
- ▶ Well-defined water rights for both surface and groundwater are crucial to effective water management.
- ▶ Stakeholder participation is valuable for reflecting the community interest, building support, and for conserving and protecting water resources.
- ▶ Educational programs and capacity building can increase environmental awareness and increase functional effectiveness of overall water resources governance.
- ▶ Enhanced water and data information can provide essential decision support for effective water management.

Chapter 5 provided the revised policy guideline, which has been further developed on the basis of the collective effort of the Korean Government and the World Water Council. The policy guideline can help establish concrete green growth strategies that focus on the three dimensions of sustainable development: economic growth, environmental protection and social development with the following strategic components:

1. Water as an Engine for Growth
2. Protection and Conservation of Water Resources
3. Water for an Improved Quality of Life

Under these three strategies, the policy guideline lists 12 policy directions that should lead to successful Water and Green Growth. A number of specific policy measures that policy makers could consider for realizing Water and Green Growth are also included.

The range of challenges for achieving Water and Green Growth remains dependent on each country's socio-economic situation and natural resources endowment. Each situation requires a mix of policy instruments that could combine one or more of state-driven, market-oriented, and community-centered institutional tracks to realize green growth in practical terms. Such policy mix is crucial to deal with water related issues, which are cross-cutting. Thus, a combination of institutions and policy instruments or a policy mix is imperative to address a wide range of challenges.

In order to help policy makers select appropriate policies for Water and Green Growth, Chapter 5 has discussed a variety of policy implementation mixes, such as the State-driven + Market-oriented Policy Mix (SM Mix), the Market-oriented + Community-centered Policy Mix (MC Mix), and the State-driven + Community-centered Policy Mix (SC Mix). These policy mix examples have well been explained based on the analysis of the relevant case studies that are already discussed in Chapter 4. These can help policy makers to make a diagnosis of their current policies, set appropriate targets and review policy options that would be effective in their national circumstances.

As the final step, this study has suggested an policy implementation roadmap. The roadmap for Water and Green Growth can differ depending upon socio-economic and political situations in accordance with development objectives in different countries. However, there are common elements to be generally

applicable. Policy makers should consider both short-term and long-term implementation timeframes. An policy implementation roadmap can be established following the four steps: 1) diagnosis of key challenges and opportunities; 2) specific target setting; 3) selection of appropriate policy implementation mix; and 4) implementation of policy instruments for Water and Green Growth.

6.2 The Future of Water and Green Growth

Global Trends: Water Crises and Climate Change

Two notable global trends came to the fore in early 2015 that relate to water and the environment. First, the World Economic Forum in its Global Risks Report 2015 moved 'Water Crises' to first on its list of Top Ten Risks in terms of impact in 2015, above diseases, weapons, interstate conflict, failure of climate change adaptation, and other global risks, such as fiscal crises (Walton, 2015). Water is expected to grow as a global risk over the next 10 years. This was a topic at the top of the agenda for the World Economic Forum's Annual Meeting from 21-24 January 2015. Business and political leaders gathered in Davos, Switzerland were challenged to take responsibility for tackling the world's water problems together. Water and Green Growth is one of the solutions that may offer political and business leaders a way to avert crises in the future – by building resilient watershed communities and ensuring that ecosystem needs are considered in their economic growth scenarios.

The second trend is that reports issued by the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA) in early 2015 showed that 2014 was the hottest year on earth since record-keeping began in 1880. Extreme heat covered Alaska and much of the western United States last year, while many European countries set temperature records. The scientists report that the ocean surface temperature was unusually warm almost everywhere except Antarctica, which fueled damaging Pacific storms. The records show that the hottest years on record were 2005, 2010, and 2014, and that the 10 warmest years have all occurred since 1997 (Gillis, 2014). Climate change poses long-term risks to civilization and nature, and adaptation will be one of the most formidable challenges facing our world in coming years.

Key International Events in 2015

At the same time, the year 2015 provides a number of significant opportunities for national political leaders, business executives, civil society organizations, and individuals to work together to counter global threats such as water crises and climate change. Several important international events in 2015 could lead diverse actors to agree on concerted action to reduce harm to the environment and support national, regional, and community actions to protect water sources and ecosystems, as suggested below.

The International Decade for Action, "Water for Life", came to an end. The Decade ended on World Water Day (22 March 2015), right before the 7th World Water Forum in Korea. One of the key provisions in the resolution that established the Decade was that "the goals of the Decade should be a greater focus on water-related issues at all levels and on the implementation of water-related programs and projects, while striving to ensure the participation and involvement of women in water-related development efforts, and the furtherance of cooperation at all levels, in order to help to achieve internationally agreed water-related goals...." (General Assembly Resolution A/RES/58/217). As we move beyond the Decade, it is worthwhile to highlight the work that has involved both women and men in protecting and conserving water resources. Future efforts to achieve Water and Green Growth must take into account the importance of cooperation at all levels and ensuring the participation and involvement of women in managing our water resources and protecting the watersheds that our lives depend on, as mandated in the International Water for Life Decade, 2005-2015.

The 7th World Water Forum "Water for Our Future" has four processes which are Thematic, Regional, Political, and Science & Technology Process. The overarching theme of is "Water for Our Future" and core value is Implementation to call public attention for collective action. Among the four processes, the Thematic Process is the core process of the World Water Forum and a wide range of themes are dealt within the process such as climate change, water-related disasters, water and sanitation, transboundary river basins, and green growth. Green growth has been discussed at the 6th World Water Forum among various international stakeholders to identify effective policy tools for green growth, and consensus was made to develop a policy framework for other countries. In this regard, the Korean government and the World Water Council initiated the international research project, Water and Green Growth.

With concerted efforts to disseminate the importance on the role of water in green growth, Water and Green Growth became one of an important global agenda. Among the 16 themes in the Thematic Process, 3.1. Green Growth, Water Stewardship and Industry was established. In particular, green growth was reiterated its importance in the Asia and Pacific region as a new development strategy to pursue economic growth and environmental sustainability simultaneously. Growing concerns on population growth, rapid urbanization, and unpredictable climate change led green growth to be a new solution to address challenges the region is facing. In this regard, Asia-Pacific Regional Process selected Water and Green Growth as one of the agenda to be discussed at the 7th World Water Forum. K-water and UNESCAP are co-session coordinators. The session explored applicability of green growth in the Asia-Pacific region. As a preparation process for the Forum, K-water and ESCAP hosted expert group meetings three times in Stockholm, Seoul, and Bangkok.

Global Talks on Climate Change. Governments will meet in Paris in late 2015 for negotiations on a legally binding and universal agreement on climate for all nations of the world. Successful mitigation of and adaptation to climate change depends not only on governments, but also on the active and sustained engagement of stakeholders including national, regional, and international organizations, the public and private sectors, civil society, and individuals. Adaptation to the impacts of climate change can take place at multiple levels, regions, and sectors (such as water resources).⁷⁾

The Sustainable Development Goals (SDGs) are to be adopted in September 2015 for the post-Millennium Development Goals (MDGs) period. As part of the MDGs a target on water supply and sanitation was included under Goal 7 (Target 7C): To reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation. Over the period of the MDGs and the "Water for Life" Decade, the countries of the world made substantial progress and were able to achieve the goal in clean drinking water supply before the deadline, but they remained far behind in providing access to improved sanitation. At the end of the Decade, it is estimated that over 89% of the

world's population had access to improved drinking water supply (compared to 76% in 1990), but only 64% of the world's population had access to improved sanitation (compared to 49% in 1990).⁸⁾ Deputy Secretary-General Jan Eliasson issued a Call to Action on Sanitation in May 2014.⁹⁾ In the post-2015 period, a renewed focus will have to emphasize the important role of sanitation and wastewater treatment in protecting our water resources and making more water available for productive use.

International organizations, governments, the private sector, and civil society organizations will need to work together to set realistic priorities for achieving the SDGs. All of these international efforts must be harmonized and coordinated to reduce the risk of serious global water crises in the near future. Attention to climate change, protection of water sources and ecosystems, and participation of all stakeholders will be needed to achieve sustainable economic growth. International cooperation is a driving goal of the Water and Green Growth Project and is critical to addressing environmental issues, such as climate change and integrated river basin management, as well as economic issues, including trade agreements, watershed and resource protection and water transportation. It is also essential for technology transfers, development cooperation, capacity building, and disaster preparedness. The Water and Green Growth concept presents a new paradigm for understanding the formidable challenges of water management in the course of socio-economic development. The policy guideline, coupled with practical policy options, can make a major contribution to the achievement of the SDGs over the next 15 years.

It is worth paying special attention to the WGG Project, in the context of the post-2015 SDGs and the negotiations on climate change. The magnitude of water-related issues in sustainable development has been widely recognized over the last 15 years since the adoption of the MDGs by Heads of State in 2000. In the context of the SDGs, the Water and Green Growth Project can provide practical approaches to using water as a vector through which green growth can occur in both developed and developing countries. Most countries need to rethink their approaches to

7) UN Framework Convention on Climate Change <http://unfccc.int/focus/adaptation/items/6999.php>

8) WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation, 2014 Update. http://www.wssinfo.org/fileadmin/user_upload/documents/Four-page-JMP-2014-Snapshot-standard-on-line-publishing.pdf

9) Deputy Secretary-General's remarks at Media Launch of Sanitation Campaign. New York, United Nation

water management. Policy makers would benefit from applying the recommendations in this report to set their countries on a more sustainable economic development path.

The Future of Water and Green Growth

The Water and Green Growth Project has come to an end in 2015. As a final outcome of the project, this report provides the policy guideline, the policy mix and the policy implementation roadmap. Yet much work remains to be done. The range of policy directions and concrete policy instruments need to be more comprehensively identified through analyses of more case studies. In addition, to evaluate the effectiveness of institutions and assess performance of projects, Water and Green Growth indicators should be developed and standardized. This continuing work agenda for Water and Green Growth leads to another important milestone, in particular the next 8th World Water Forum. The range of policy directions and concrete policy instruments already identified need to be tested to determine their performance, other policy instruments can be comprehensively.

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APPENDIX A. Results of Quantitative Analysis on Institution and Policy Effectiveness

The analysis focuses on the 11 case studies in order to evaluate the effectiveness of institutions and policies related to the Water and Green Growth approach.

Data (Research Material)

Survey data

The main content for the questionnaires consists of the questions on state-driven, market-oriented and community-centered implementation policies and institutions. In addition, the survey includes questions about the project performance in economic, environmental and social dimensions. (See Appendix A and B). The number of survey respondents ranged from 13 to 27 for the case studies.

Descriptive statistics for institutional and performance variables

The database for the study includes the survey data obtained through questionnaires. The model used in this study is based on survey information, using estimates from a sample consisting of the 11 case studies.

The questionnaires were extremely detailed and the collection of the information from the 204 respondents was scrupulously carried out. The questionnaire covered state-driven, market-oriented and community-centered institutions and Water and Green Growth performance. State-driven institutions include water law and administration (legal treatment, balance among government layers, organizational basis and structure of water administration) and water policy (well organized plans, financial support, tax and levies, regulation and technology/R&D policies). Market-oriented institutions include water law and administration (water rights and scope of private participation) and water policy (cost-recovery, private investment, private operation, project selection criteria). Similarly, community-centered institutions compose water law and administration (conflict resolution mechanisms, accountability provisions and arrangements, adequacy and relevance of the information,

integrated approach to water planning and development) and water policy (stakeholder participation, coordination mechanisms, integrated approach, access to information).

Estimation results

The effectiveness of state-driven institutions

Effectiveness of the state-driven laws and administrations

Based on the cases that could be included in the model for effectiveness of state-driven institutions, the most significant variable is the coordination mechanism for water administration. When the coordination mechanism functions well a positive impact on the overall effectiveness of state-driven institutions is expected.

According to the estimated results from the analysis, the higher the coordination mechanism score gains, the more effective state-driven institutions become. Likewise, a stronger interaction of government layers between ministries and central, regional and local governments indicates higher effectiveness of state-driven institutions. However, the ability to distinguish legal terms did not seem to be significant in terms of the effectiveness of state-driven institutions.

Effectiveness of the state-driven Policies

State-driven policy was found to have a stronger influence on the effectiveness of state-driven institutions than legal and administrative systems. In particular, well-organized water plans and relevant regulations appear to have a strong impact on institutions' effectiveness on a large scale. Project-related financial support and development of green technology were not found to be significant for the effectiveness of institutions.

The effectiveness of market-oriented institutions

Effectiveness of the market-oriented laws and administrations

The most effective variable in evaluating the effectiveness of market-oriented institutions was the extent to which the private sector is allowed to participate in water supply and sanitation

for industrial and commercial sites, river management and flood control. We can find evidence in the case study of Nepal, Shanghai-Pudong and Ecuador. Private sector involvement in operation and maintenance of water projects was found to be more effective and had a positive impact.

Effectiveness of the market-oriented policies

As a result of quantitative analysis, the market-oriented policies did not have a statistically significant impact on the effectiveness of market-oriented institutions. However, in the case study report, economic instruments such as PES, environmental taxes and private participation are able to change unsustainable behaviors of water users, support financing sources and enhance efficiency.

The effectiveness of community-based institutions

Effectiveness of the community-centered laws and administrations

The study indicates that the effectiveness of community-based institutions depends on an Integrated Water Resources Management (IWRM) to water management. In practice, there are Brazil and

Egypt that introduced IWRM to their country to manage water efficiently. But, other aspects of community-based laws and administrative systems were not found to be statistically significant on the effectiveness of community-centered institutions. In the case study reports, stakeholder participation, extent to access to information and coordination mechanism take an important role to bring stakeholders in decision-making process.

Effectiveness of the community-based policies

It is estimated that decentralization is not being influenced to the effectiveness of community-based institutions. However, the active participation of regional governments, NGOs, and communities in the decision-making processes does appear to have a positive impact on the effectiveness of community-based institutions. In most of the cases, stakeholder participation played a vital role to bring up problems, monitor how policies to be implemented and problems to be solved. To enhance efficiency of stakeholder participation, inclusion of diverse stakeholders with equitable right to speak needs to be empowered.

Table A-1. Descriptive Statistics for Institutional and Performance Variables¹⁰⁾

| Category | Variables | TYPE | Mean | Std. Dev. | Min | Max |
|--|---|-------|-------|-----------|-----|-----|
| Legal treatment of different water sources | Surface and groundwater are treated alike | dummy | 0.296 | 0.458 | 0 | 1 |
| | Laws discriminate between public and private parties | dummy | 0.367 | 0.483 | 0 | 1 |
| | Laws discriminate across sectors such as irrigation, household, and industrial uses | dummy | 0.836 | 0.371 | 0 | 1 |
| | Priority of consumptive and non-consumptive uses | dummy | 0.423 | 0.495 | 0 | 1 |
| Legal linkages between water and water-related resources | Land and ground water | dummy | 0.642 | 0.481 | 0 | 1 |
| | Land and surface water | dummy | 0.732 | 0.444 | 0 | 1 |
| | Forest, environment and water | dummy | 0.698 | 0.460 | 0 | 1 |
| Role of government layers | Central government | scale | 5.755 | 3.058 | 0 | 10 |
| | State or regional government | scale | 5.931 | 3.235 | 0 | 10 |
| | Local government | scale | 5.242 | 3.298 | 0 | 10 |
| | Existence of ministries | dummy | 0.633 | 0.483 | 0 | 1 |
| | Coordination of water-related ministries | scale | 5.616 | 2.051 | 0 | 10 |

10) Questions in 'performance' part; economic performance, social performance, environmental performance were required to respond on a scale of 1 to 9, 9 should be understood as most positive; 5 should be understood as having no impact; 1 should be understood as most negative. These are recalculated to a scale of -10 to 10, based on 0. The average of each performance is mean value of each component.

| Category | Variables | TYPE | Mean | Std. Dev. | Min | Max |
|---|--|-------|-------|-----------|-----|-----|
| Authority and structure of water administration | Administrative division | dummy | 0.711 | 0.455 | 0 | 1 |
| | Hydro-geological regions | dummy | 0.100 | 0.301 | 0 | 1 |
| | River basins | dummy | 0.592 | 0.493 | 0 | 1 |
| Well-organized plans | Well-organized plans | dummy | 0.811 | 0.393 | 0 | 1 |
| | Effectiveness of well-organized plans | scale | 6.236 | 2.778 | 0 | 10 |
| Financial support | Existence of financial support such as subsidies or ODA | dummy | 0.511 | 0.501 | 0 | 1 |
| | Effectiveness of financial support plan | scale | 7.753 | 1.840 | 3 | 10 |
| Taxes and Levies | Taxes and levies | dummy | 0.461 | 0.500 | 0 | 1 |
| | Effectiveness of taxes and levies | scale | 4.425 | 2.652 | 0 | 10 |
| Effectiveness of regulations | Regulations | dummy | 0.646 | 0.480 | 0 | 1 |
| | Effectiveness of regulations | scale | 6.667 | 3.140 | 0 | 10 |
| Technology / R&D policies | Green technology and innovative technology | dummy | 0.788 | 0.410 | 0 | 1 |
| | Effectiveness of deployed green technology | scale | 2.563 | 1.082 | 0 | 4 |
| Water rights | Allowance of private water rights | dummy | 0.529 | 0.500 | 0 | 1 |
| Scope of private participation | Irrigation | dummy | 0.618 | 0.487 | 0 | 1 |
| | Household | dummy | 0.680 | 0.468 | 0 | 1 |
| | Industry | dummy | 0.719 | 0.451 | 0 | 1 |
| | River management and flood control | dummy | 0.432 | 0.497 | 0 | 1 |
| | Planning | dummy | 0.615 | 0.488 | 0 | 1 |
| | Engineering and construction | dummy | 0.772 | 0.421 | 0 | 1 |
| | Operation and maintenance | dummy | 0.743 | 0.438 | 0 | 1 |
| | Investment | dummy | 0.693 | 0.463 | 0 | 1 |
| Water pricing cost-recovery | Irrigation | dummy | 0.129 | 0.337 | 0 | 1 |
| | Household use | dummy | 0.210 | 0.409 | 0 | 1 |
| | Industry | dummy | 0.301 | 0.460 | 0 | 1 |
| Private sector promotion policies | Scope of participation | scale | 7.279 | 2.973 | 0 | 10 |
| Project Selection Criteria | Financial factors | dummy | 0.764 | 0.426 | 0 | 1 |
| | Equity factors | dummy | 0.520 | 0.501 | 0 | 1 |
| | Ecological factors | dummy | 0.736 | 0.442 | 0 | 1 |
| Conflict resolution and coordination | Specified conflict-resolution mechanisms in law | dummy | 0.620 | 0.487 | 0 | 1 |
| Accountability | Legal provisions for the accountability of officials, water suppliers, and users | dummy | 0.789 | 0.409 | 0 | 1 |
| Adequacy and Relevance of Information | Whether water data is collected and managed | dummy | 0.611 | 0.489 | 0 | 1 |
| Integrated approach | Applicability of IWRM | dummy | 0.644 | 0.480 | 0 | 1 |
| Decentralization | State policies which favor decentralization | dummy | 0.738 | 0.441 | 0 | 1 |
| Stakeholder participation | Preference of stakeholder participation policies | scale | 6.875 | 2.037 | 1 | 10 |
| | Effectiveness of central government's decision making | scale | 5.697 | 3.274 | 0 | 10 |
| | Effectiveness of regional government's decision making | scale | 5.877 | 3.306 | 0 | 10 |
| | Effectiveness of local government's decision making | scale | 5.955 | 3.098 | 0 | 10 |
| | Effectiveness of NGO's decision making | scale | 4.674 | 3.257 | 0 | 10 |
| | Effectiveness of residents and community | scale | 5.044 | 2.892 | 0 | 10 |
| | Effectiveness of firm's decision making | scale | 5.025 | 3.225 | 0 | 10 |
| Effectiveness of institutions | Effectiveness of state-driven institutions | scale | 6.281 | 2.687 | 0 | 10 |
| | Effectiveness of market-oriented institutions | scale | 5.135 | 2.636 | 0 | 10 |
| | Effectiveness of community-centered institutions | scale | 5.853 | 2.509 | 0 | 10 |

| Category | Variables | TYPE | Mean | Std. Dev. | Min | Max |
|---------------------------|---|-------|-------|-----------|--------|--------|
| Economic performance | Economic Performance (average) | scale | 3.852 | 2.968 | -6.25 | 10 |
| | Increases in GRDP | scale | 3.617 | 4.145 | -10 | 10 |
| | Job creation in the local economy | scale | 3.440 | 3.748 | -7.5 | 10 |
| | Local development to national standards | scale | 4.000 | 3.979 | -10 | 10 |
| | Technological performance and technological advancement | scale | 4.203 | 3.451 | -7.5 | 10 |
| Social performance | Social performance (average) | scale | 3.824 | 2.836 | -6.875 | 10 |
| | Improvement of people's health | scale | 4.267 | 4.102 | -7.5 | 10 |
| | Improvement in quality of life | scale | 5.568 | 3.892 | -7.5 | 10 |
| | Increased citizen participation in decision making | scale | 3.773 | 3.617 | -10 | 10 |
| | Increased gender equality | scale | 1.561 | 3.475 | -10 | 10 |
| Environmental performance | Environmental performance (average) | scale | 4.946 | 3.188 | -7.5 | 10 |
| | Improvement in water quality | scale | 6.124 | 3.299 | -2.5 | 10 |
| | Maintaining or restoring biodiversity | scale | 5.036 | 4.003 | -10 | 10 |
| | Improvement in disaster preparedness | scale | 2.927 | 3.886 | -10 | 10 |
| | Increased environmental awareness | scale | 5.767 | 3.593 | -7.5 | 10 |
| | Overall performance (average) | scale | 4.173 | 2.633 | -7.5 | 9.5833 |

Table A-2. Effects of the Legal and Administrative System

| Type | Variable | Coefficient Value | Standard Variables | t-Value | P→ t |
|--|--|-------------------|--------------------|---------|-------|
| Perception of laws about the water resources | Difference between surface and ground water | -0.044 | 0.619 | -0.070 | 0.943 |
| | Discrimination between private and public sector | -0.217 | 0.669 | -0.320 | 0.747 |
| | Distinguish irrigation, household and industrial uses | 0.045 | 0.793 | 0.060 | 0.955 |
| | Priority and treatment of consumptive and non-consumptive uses | 0.523 | 0.684 | 0.760 | 0.447 |
| Legal linkages between water and water-related resources | Land and ground water | 1.611** | 0.788 | 2.050 | 0.045 |
| | Land and surface water | -1.021 | 0.750 | -1.360 | 0.178 |
| | Forest, environment and water | 0.107 | 0.767 | 0.140 | 0.890 |
| Role of government layers | Central government | -0.041 | 0.124 | -0.330 | 0.743 |
| | State or regional government | 0.273** | 0.116 | 2.360 | 0.021 |
| | Local government | -0.109 | 0.097 | -1.130 | 0.263 |
| | Supervisory and regulatory institution | 0.016 | 0.100 | 0.160 | 0.873 |
| Coordination mechanism of water-related administration | Existence of exclusive department of water resources | -0.315 | 0.808 | -0.390 | 0.698 |
| | Coordination of water administration | 0.673** | 0.178 | 3.780 | 0.000 |
| Authority and structure of water administration | Administrative division | 0.131 | 0.772 | 0.170 | 0.866 |
| | Hydro-geological regions | -0.723 | 0.966 | -0.750 | 0.457 |
| | River basins | 1.240 | 0.782 | 1.590 | 0.117 |
| | constant term | -0.112 | 1.860 | -0.060 | 0.952 |

Table A-3. Effects of Policy

| Variable | Coefficient Value | Standard Variables | t-Value | P→ t |
|---------------------------------|-------------------|--------------------|---------|-------|
| Well-organized plans | 1.397** | 0.547 | 2.550 | 0.012 |
| Financial support | 0.666 | 0.427 | 1.560 | 0.120 |
| Taxes and levies | -0.862*** | 0.439 | -1.960 | 0.052 |
| Regulations | 1.198** | 0.476 | 2.510 | 0.013 |
| Green technology and R&D policy | -0.946*** | 0.527 | -1.790 | 0.075 |
| Constant term | 5.129 | 0.736 | 6.970 | 0.000 |

Table A-4. The Effectiveness of Market-oriented Institutions

| Type | Variables | Coefficient Value | Standard Variables | t-Value | P→ t |
|--------------------------------|------------------------------------|-------------------|--------------------|---------|-------|
| Private water rights | Allowed private water rights | 0.529 | 0.448 | 1.180 | 0.240 |
| Scope of private participation | Irrigation | -0.549 | 0.518 | -1.060 | 0.291 |
| | Household | -1.474** | 0.647 | -2.280 | 0.024 |
| | Industry | 1.332* | 0.736 | 1.810 | 0.072 |
| | River management and flood control | 1.313* | 0.505 | 2.600 | 0.010 |
| | Planning | 0.678 | 0.543 | 1.250 | 0.214 |
| | Engineering and construction | -0.067 | 0.825 | -0.080 | 0.936 |
| | Operation and maintenance | 1.700* | 0.870 | 1.950 | 0.053 |
| | Investment | 0.023 | 0.654 | 0.040 | 0.972 |
| | Constant term | 3.125 | 0.587 | 5.320 | 0.000 |

Table A-5. Effects of Policy System

| Type | Variables | Coefficient Value | Standard Variables | t-Value | P→ t |
|-----------------------------------|---|-------------------|--------------------|---------|-------|
| Water pricing cost-recovery | Irrigation | 1.747*** | 0.981 | 1.780 | 0.078 |
| | Household use | -0.262 | 1.017 | -0.260 | 0.798 |
| | Industry | 0.081 | 0.831 | 0.100 | 0.922 |
| Private sector promotion policies | Favorable to participation of private sectors | -0.087 | 0.100 | -0.880 | 0.383 |
| Project Selection Criteria | Financial factors | -2.189* | 1.314 | -1.670 | 0.099 |
| | Equity factors | 0.206 | 0.654 | 0.310 | 0.754 |
| | Ecological factors | -1.572* | 0.795 | -1.980 | 0.051 |
| | Constant term | 8.192 | 1.438 | 5.700 | 0.000 |

Table A-6. Effectiveness of Community-centered Institutions

| | Coefficient Value | Standard Variables | t-Value | P→ t |
|--|-------------------|--------------------|---------|-------|
| Conflict resolution and coordination | 0.182 | 0.496 | 0.370 | 0.714 |
| Accountability of officers and water suppliers | 0.150 | 0.606 | 0.250 | 0.805 |
| Adequacy and Relevance of Information | 0.296 | 0.431 | 0.690 | 0.493 |
| Integrated approach | 0.837** | 0.417 | 2.010 | 0.047 |
| Constant term | 4.861 | 0.541 | 8.980 | 0.000 |

Table A-7. Effects of Policy

| | Coefficient Value | Standard Variables | t-Value | P→ t |
|--|-------------------|--------------------|---------|-------|
| State policies which favor decentralization | 0.603 | 0.634 | 0.950 | 0.345 |
| Preference of stakeholder participation policies | -0.050 | 0.137 | -0.370 | 0.715 |
| Effectiveness of central government's decision making | -0.046 | 0.085 | -0.540 | 0.592 |
| Effectiveness of regional government's decision making | 0.160** | 0.076 | 2.110 | 0.038 |
| Effectiveness of local government's decision making | 0.065 | 0.095 | 0.680 | 0.499 |
| Effectiveness of NGO's decision making | 0.422*** | 0.085 | 4.950 | 0.000 |
| Effectiveness of residents and community | 0.169* | 0.093 | 1.820 | 0.074 |
| Constant term | 2.279 | 1.088 | 2.090 | 0.040 |

Table A-8. The Effects of Institutions' Effectiveness on Economic Performance

| | Coefficient Value | Standard Variables | t-Value | P→ t |
|---|-------------------|--------------------|---------|-------|
| Effectiveness of state-driven institution | 0.256* | 0.088 | 2.930 | 0.004 |
| Effectiveness of market-oriented institution | 0.239* | 0.090 | 2.650 | 0.009 |
| Effectiveness of community-centered institution | -0.131 | 0.091 | -1.440 | 0.153 |
| Constant term | 1.842 | 0.947 | 1.950 | 0.054 |

Table A-9. The Influence of Institutions' Effectiveness on Social Performance

| | Coefficient Value | Standard Variables | t-Value | P→ t |
|---|-------------------|--------------------|---------|-------|
| Effectiveness of state-driven institution | 0.220** | 0.087 | 2.520 | 0.013 |
| Effectiveness of market-oriented institution | 0.128 | 0.090 | 1.420 | 0.157 |
| Effectiveness of community-centered institution | 0.193** | 0.090 | 2.130 | 0.035 |
| Constant term | 0.791 | 0.945 | 0.840 | 0.404 |

Table A-10. The Influence of Institutions' Effectiveness on Environmental Performance

| | Coefficient Value | Standard Variables | t-Value | P→ t |
|---|-------------------|--------------------|---------|-------|
| Effectiveness of state-driven institution | 0.201** | 0.093 | 2.170 | 0.032 |
| Effectiveness of market-oriented institution | 0.208** | 0.099 | 2.110 | 0.036 |
| Effectiveness of community-centered institution | 0.068 | 0.100 | 0.680 | 0.500 |
| constant term | 2.191 | 1.029 | 2.130 | 0.035 |

Table A-11. The Influence of Institutions' Effectiveness on Overall Performance

| | Coefficient Value | Standard Variables | t-Value | P→ t |
|---|-------------------|--------------------|---------|-------|
| Effectiveness of state-driven institution | 0.267** | 0.075 | 3.540 | 0.001 |
| Effectiveness of market-oriented institution | 0.148*** | 0.078 | 1.900 | 0.060 |
| Effectiveness of community-centered institution | 0.044 | 0.079 | 0.560 | 0.576 |
| constant term | 1.569 | 0.815 | 1.920 | 0.056 |

APPENDIX B. Results of Quantitative Analysis on Effectiveness of Policy Mix

The WGG Team asked local consultants to collect at least 20 questionnaires for each case study, including at least 1 Type A. Type A was to be completed by the project manager(s) or persons(s) with the most intimate knowledge of the project or case. Type B questionnaires were completed by other stakeholders with a competent knowledge of and legitimate connection to the project.

Measuring performance requiring responses on a scale of 1 to 9, 9 should be understood as most positive; 5 should be understood as no impact; and 1 should be understood as most negative. The questionnaire is referred to the Appendix A

B-1. State-driven + Market-oriented Policy Mix

| | Measuring Performance | Brazil | China (Pudong, Shanghai) | Egypt | Turkey (Goldenhorn) |
|-------------|---------------------------|--------|--------------------------|-------|---------------------|
| Economic | GRDP | 2.08 | 3.86 | 8.85 | 4.26 |
| | Job Creation | 2.5 | 3.07 | 7.31 | 6.47 |
| | Local Development | 2.08 | 4.32 | 1.54 | 7.06 |
| | Technological Advancement | 3.47 | 5.21 | 8.65 | 6.25 |
| Environment | Water Quality | 5.13 | 6.48 | 8.85 | 8.68 |
| | Biodiversity | 4.08 | 1.67 | 8.08 | 8.09 |
| | Disaster Safety | 2.89 | 0.87 | 3.27 | 2.81 |
| | Environmental Awareness | 5.53 | 4.27 | 5.38 | 7.81 |
| Social | Public Health | 2.76 | 5.66 | 3.85 | 8.17 |
| | Quality of Life | 4.08 | 5.71 | 7.5 | 8.68 |
| | Citizen Participation | 2.37 | 3.3 | 1.73 | 2.97 |
| | Gender Equality | 0.83 | 1.67 | -0.19 | 0 |

B-2. Market-oriented + Community-centered Policy Mix

| | Measuring Performance | Australia, Murray-Darling Basin | Ecuador | Nepal |
|-------------|---------------------------|---------------------------------|---------|-------|
| Economic | GRDP | -0.69 | -2.5 | 6.13 |
| | Job Creation | -0.39 | 1.25 | 5.88 |
| | Local Development | 0.83 | 0.67 | 6.13 |
| | Technological Advancement | 2.92 | 1 | 4.63 |
| Environment | Water Quality | 1.97 | 6.09 | 3.5 |
| | Biodiversity | 3.55 | 6.56 | 3 |
| | Disaster Safety | -0.39 | 3.59 | 1.13 |
| | Environmental Awareness | 4.87 | 6.72 | 4.5 |
| Social | Public Health | -0.56 | 2.97 | 5.88 |
| | Quality of Life | 0.53 | 4.53 | 5.88 |
| | Citizen Participation | 2.5 | 5 | 4.5 |
| | Gender Equality | -0.26 | 5.31 | 3.75 |

B-3. State-driven + Community-centered Policy Mix

| | Measuring Performance | Republic of Korea, Sihwa | India | Spain, Ebro | Republic of Korea, Taehwa |
|-------------|---------------------------|--------------------------|-------|-------------|---------------------------|
| Economic | GRDP | 5.75 | 5.44 | 2.21 | 7 |
| | Job Creation | 6 | 3.68 | 1.81 | 5 |
| | Local Development | 8.75 | 4.12 | 0.56 | 8 |
| | Technological Advancement | 3.75 | 4.69 | 2.78 | 5 |
| Environment | Water Quality | 3.25 | 5.16 | 5.79 | 9 |
| | Biodiversity | 8 | 3.68 | 4.08 | 8 |
| | Disaster Safety | 7.75 | 3.53 | 5.39 | 8 |
| | Environmental Awareness | 3.5 | 4.41 | 3.75 | 9 |
| Social | Public Health | 9 | 4.26 | 2.36 | 9 |
| | Quality of Life | 8.25 | 5.59 | 3.19 | 9 |
| | Citizen Participation | 4.75 | 2.79 | 5.28 | 7 |
| | Gender Equality | 8.75 | 3.86 | -0.44 | 4 |



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