

**A Study on the challenges and alternatives for the water resources management**

By

**JUNG, Won Sub**

**CAPSTONE PROJECT**

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

**MASTER OF PUBLIC MANAGEMENT**

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Approval as of May, 2024

# Acknowledgements

While working at a company, I have been working on water for a long time. When I was halfway through the company, I wanted to write down what I had been thinking about. This capstone began with such a small wish of mine. In the process of writing, I received a lot of help from KDI professors and colleagues, including Professor Lee Jun-soo. Professor Lee Jun-soo was an inspiration to me in all aspects, such as academic and life attitudes. Other in-depth classes and concerns of KDI professor really gave me the will to work harder. I am also repeatedly grateful to the company for meeting many excellent professors and students at KDI. This time really gave me a foundation to think about a lot and leap forward again. At a time when I still have to spend a lot of time at work, I promise to study more, think hard, and communicate with many people to complete the other half of this capstone.

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# Abbreviations

ADR: Alternative Dispute Resolution

BWMC : Basin Water Management Committee

KHNP: Korea Hydro and Nuclear Power Corporation

KR: Korea Rural Community Corporation

KE: Korea Environment Corporation

K-water: Korea Water Resources Corporation

KFS : Korea Forest Service

NWMC : National Water Management Committee

MAFRA: Ministry of Agriculture, Food and Rural Affairs

MoE: Ministry of Environment

MoIS: Ministry of the Interior and Safety

MoLIT: Ministry of Land, Infrastructure and Transport

MoTIE: Ministry of Trade, Industry and Energy

NGOs: Non-Governmental Organizations

OECD: Organization for Economic Cooperation and Development



# **Executive summary**

The paradigm of water resource management changes with the passage of time. In order to design an optimized system for water resource management in Korea, it is first necessary to analyze the current situation. At a time when the current climate change crisis, the increasing demand for water, and the conflict of interest over water security are intensifying, the inefficiency and sustainability of our system must be improved to solve these challenges.

First of all, it is necessary to change the water resource management system. Segmented tasks between institutions should be linked, and scattered plans and systems should be integrated. In terms of operation, it is necessary to derive a method that can improve social acceptance by breaking away from the past one-way policy operation. Therefore, it should be noted to establish water governance that fits the situation in Korea. In addition, a system that can minimize conflicts between stakeholders should be established. Finally, in terms of sustainability, it is also necessary to consider how to cultivate manpower and secure an appropriate budget. In this study, a solution to each problem is presented.

In conclusion, in order to solve the problem of water resources, it is necessary to derive tasks with high social acceptability by efficiently utilizing governance. After that, an efficient and sustainable process should be established to derive policy results optimized for water management. Through this, we will have to maximize the efficiency of water management and turn the upcoming crisis of water problems into opportunities.

## **I. Introduction**

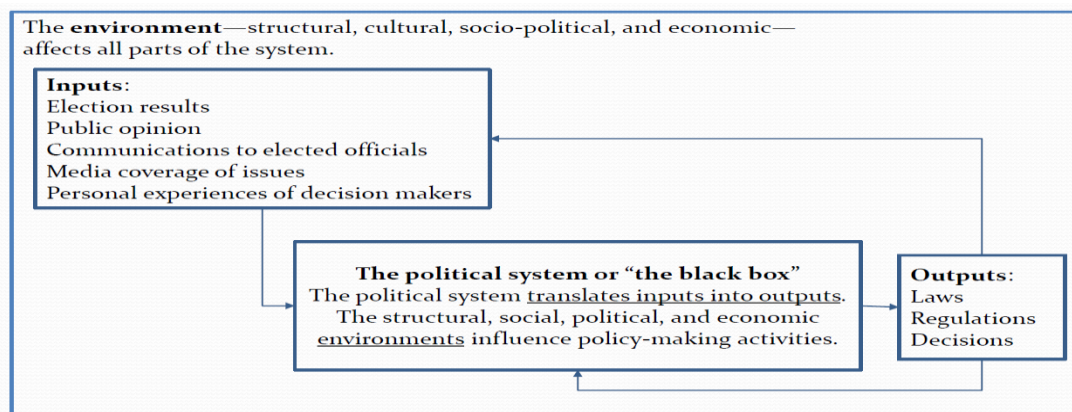
### ***A. Background***

Recently, there have been significant changes in water management in Korea. This change began with a sense of the problem of performing water management independently by various institutions. Problems arising in modern society include diversity, complexity, and dynamics, which are clearly distinguished from the past. Therefore, it was difficult to solve complex and diverse water-related problems using only the abilities of individual institutions with limited knowledge and information (K-water, 2019). As a result, it was exposed to many limitations and problems. Water flow was not fragmented. It is interconnected in every process from rainwater to sewage. Therefore, systematic management is required throughout the water circulation process. Social efforts were required to consider water solutions from an overall perspective by breaking away from the perspective of parts. Following this consideration, the implementation of integrated water management began in earnest. First, the Ministry of Environment (MoE) unified the water management work scattered across each ministry, including the Ministry of Land, Infrastructure and Transport (MoLIT). In addition, the Framework Act on Water Management took effect in June 2019, and the National Water Management Committee (NWMC) and Basin Water Management Committee (BWMC) were launched following the same law. In June 2021, the National Water Management Basic Plan—the national top-level plan for water management—was established and confirmed, and the implementation plan was established in December of the same year.

However, the establishment of these systems and organizations does not directly lead to the achievement of efficient water management. It is necessary to establish effective political, administrative, and economic systems; secure a clear legal framework; participate in various people; and establish countermeasures for the future while eliminating existing inefficiencies.

At these times of change, we need to diagnose the current state of water management, identify problems, and improve it. The water-related system is what I will continue to make and modify to fit reality here. A successful system construction produces good output values and results. Many discussions need to be considered for these systems. Because the definitions and solutions of various problems change according to the changes in the times, systems and institutions are also bound to show fluid appearances. For example, alcoholism was seen as an individual problem in the past and could be solved by punishment. However, it is a social problem and disease that is currently being solved through treatment, counseling, and social services. According to this definition, systems for problem solving change.

**[Figure 1 ] Political system (Eston, 1965)**



The paradigm of water management is constantly changing. In keeping with this changing trend, we need to establish new directions and strategies for water management and build a better system. To do this, we need to clearly identify and analyze the opportunities and threats of water management and the great capabilities and deficiencies that we have today.

***B. Problems with the water management system***

I would then like to analyze the problems of water management in Korea using the SWOT technique as a prerequisite for deriving improvement measures to be discussed in earnest in the

future.

### ***1 . An opportunistic factor***

The first opportunity factor is that the paradigm of water management is changing in earnest. In the past, water management focused on a stable water supply for economic and industrial development. On the other hand, water management is now more focused on improving the quality of life of people by considering all factors such as the ecology of water, water quality, and water quantity (Jung, 2019). The public's interest is also increasing more than ever. As the interest of the government or companies increases, new industrial ecosystems are being formed along with active investment. For example, investments in ultrapure water required for manufacturing semiconductors and active research on water quality improvement technologies to prevent green algae are being conducted. Second, the uncertainty of water management is increasing because of the increasing global population, urbanization, climate change, and ecological change. As a result, the importance of water is highlighted and national attention is focused on securing stable water. New water technologies, such as seawater desalination and sewage reuse are evolving (Shim, 2023). As a result, the global water market is projected to grow at an annual average of 4.2% (Park, 2021). The era of oil has come to an end, and now the era of water is coming in earnest. Water will be at the center of human survival and prosperity, and water-related research and investment will be more active worldwide (Kim, 2022). If Korea's systematic water management and outstanding water technology enter the global market, the water industry will become a new industrial area that expands Korea's wealth and influence. On the other hand, if related research and labor acquisition fail, Korea's water industry will likely be subordinated to advanced countries. Uncertainty in securing water and the development of the water industry can be another opportunity and threat to us.

## ***2 . Threat factor***

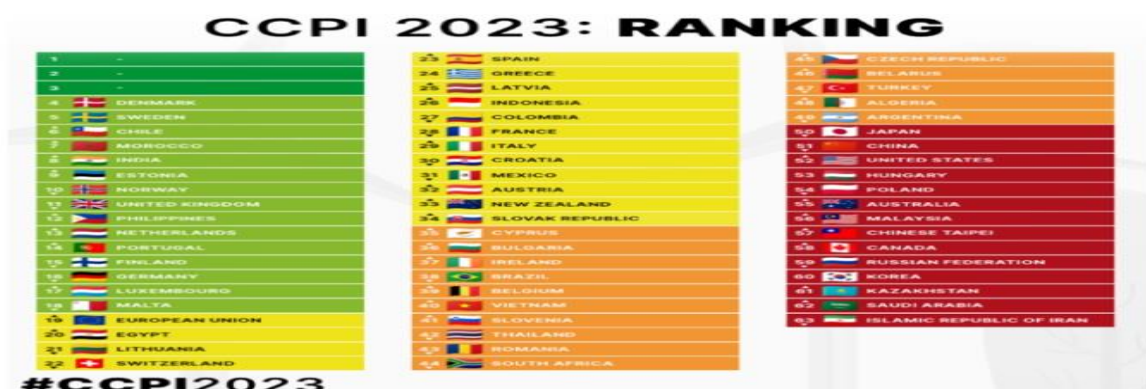
Climate change has emerged as a threat to new water management methods. Climate change has sharply increased the risk of water disasters and earthquakes. Professor Paul Krugman of the United States wrote in a 2009 New York Times article that he feared a catastrophic situation as a "clear and present danger" that humanity faces. 2022 is the year of the worst drought in the world, and 2023 is the hottest year since the birth of the Earth. UN Secretary-General António Guterres said the era of global warming is over and the era of a simmering Earth has come. The expected increase in the average global temperature by 1.5 degrees Celsius, the tipping point of the climate crisis, is accelerating more rapidly than previously expected.

The climate crisis is changing the water cycle. Triple Deep La Niña, in which the La Niña phenomenon persists for three consecutive years (NOAA Research, 2023). In addition, in mid-latitude countries such as Korea, the phenomenon of atmospheric rivers, where tremendous amounts of water vapor concentrated in the atmosphere flow like river water along narrow passages in the sky, causing torrential rain, is intensifying (Lee, 2022). Among the effects of climate change, the water sector has the most serious impact on the foundation of human life. The task at hand is to respond to extreme floods and droughts, along with increasing uncertainty in the supply of stable water resources due to climate change (Park, 2011). If we do not create appropriate countermeasures, we will not be able to avoid property and life losses that we have not experienced before.

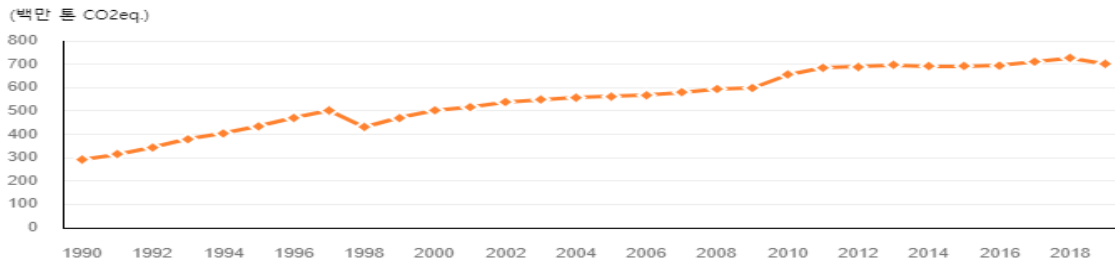
The problem is that despite the difficulties in securing water due to climate change, global water demand will continue to increase by 1% per year due to population growth and industrialization, and is expected to increase similarly by 2050 (UNESCO). On the other hand, the expansion of water supply capacity is facing the opposite of environmental and social

limitations. Existing dams are also experiencing a decline in water supply capacity due to the deposition and aging of reservoirs (Jang & Kim, 2016). Asymmetry in supply and demand and hydrological uncertainty due to the climate crisis will be the biggest challenges for a stable water supply. These effects have a great impact on the business activities of not only companies but also countries and individuals (Harvard Business Review, 2022). Externally, TSMC, a Taiwanese semiconductor company, had to transport water by truck from miles away when the local water supply was depleted due to severe drought. In Korea, POSCO suffered approximately 2 trillion won in property damage in 2022 when its plant was flooded due to flooding of the reservoir in Pohang, causing an unprecedented shutdown. In addition, despite climate change issues domestically, people do not hesitate to use electricity or water that generates a lot of carbon in their production and supply processes. Data proving that these doubts are not just concerns have recently been released. The climate research group releases the CCPI every year. The country is ranked very low at 60th place in 2023. (See Figure 1) The analysis results of Korea's greenhouse gas emissions show the problems of our efforts to cope with the climate crisis. Although the country's greenhouse gas emission growth has decreased, emissions are still on the rise. (See Figure 2) regarding carbon emissions, Koreans use 280 liters of water a day, which is about three times the global average of 110 liters. It is time to think about ways to reduce carbon emissions in the water sector.

[Figure 2] Ranking of the climate change performance index (CCPI homepage (<https://ccpi.org/>))



**[Figure 3] Status of greenhouse gas emissions in Korea**  
**(MoE, National greenhouse gas statistics)**



Threat to various water conflicts and disputes exists today and is expected in the future. Numerous conflicts are occurring domestically as well. While the demand for water resources is increasing, changes in precipitation patterns and droughts are becoming commonplace due to climate change. Accordingly, strong national management and control of water resources, which are public resources, are required (Kim & Yu & Kwater, 2019). However, in the process, conflicts and disputes with numerous stakeholders continue to occur and incur many social costs (Lim, 2013). Domestic cases will be described in detail later. To alleviate these numerous water conflicts, we should consider a new system that breaks away from the existing framework. In addition, through mutual solidarity and collective intelligence, we need to develop the strategy necessary to become a win-win game rather than a zero-sum game surrounding water resources.

### ***3 . Strengths and weaknesses factor***

Next, we will learn about the advantages and disadvantages of water management in Korea.

As a strength, Korea has expertise and technology in water management, and the government's support is also being strengthened. Korea is the second-largest country in the world in water technology patents (20%) (National Institute of Green Technology, 2020). In addition, the water industry is the most important axis of the green industry, and the government

has selected the green industry as the country's new growth engine industry and is strengthening its support (MoE, 2023). Second, Korea has considerably accumulated technology and experience in overcoming water-related disasters and is well equipped with a water resource management system. To date, we have attempted to secure the safety of dam facilities by strengthening dam safety through resident participatory watershed management, predicting and removing green algae, and improving water quality. In addition, although water management is difficult because of national and seasonal factors, the experience and knowledge accumulated in the process of overcoming such challenges have reached a considerable level.

The weaknesses include the aging of facilities such as water resources and water facilities. 40% (8 places) of the multipurpose dams (20 places) currently managed by K-water have elapsed more than 30 years. As of 2017, the number of water pipes buried in Korea amounted to 209,000 km. Among them, pipes over 20 years old account for 32.4% of the total, or 67,000 km, and pipes over 30 years old account for 13,000 km, or 6.6% of the total (Hyun, 2019). Old facilities continue to threaten stable water supply and water quality. Second, public confidence in tap water continues to decline because of green algae and water accidents. It is time to improve the water supply service to meet the high expectations of the people. In relation to tap water safety, the level of social demand for water quality is increasing day by day because of the Incheon water accident. In the event of a water supply accident, the need for immediate response and accurate information related to tap water in real time is also increasing (Water journal, 2022). Third, active participation of the public in important water management policies is not occurring. The government-led promotion of water management policy is causing social conflict and public distrust of the policy. Fourth, there is no control tower to oversee and manage the national water management policy. Since various institutions have their own responsibilities and authority by dividing the field of water management, it is inevitably



insufficient to create collaboration or synergy. If you look specifically at the national water management agency, there are MoE, MoLIT, the Ministry of Agriculture, Food and Rural Affairs (MAFRA), Ministry of the Interior and Safety (MoIS), and the Ministry of Trade, Industry and Energy (MoTIE). Public enterprises implementing the policy include the Water Resources Corporation (K-water), which manages metropolitan water supply and dams, the Korea Environment Corporation (KE), which is in charge of sewage, the Korea Rural Community Corporation (KR), which develops and manages agricultural water, and the Korea Hydro & Nuclear Power Corporation (KHNP), which is in charge of hydroelectric power generation. In addition, Korea's water management ecosystem, such as local governments in charge of local water supply, is intricately intertwined. Finally, systematic planning and system establishment are insufficient compared to developed countries, so effective policy results cannot be derived and inefficiency exists. (Kim, 2012)

### ***C. Research questions and methods***

**Table 1.** *Derivation of research projects based on SWOT*

<b>Terms</b>	<b>Summary points</b>	<b>Research questions</b>
<b>Opportunity</b>	<ul style="list-style-type: none"> <li>· Creating a foundation for expanding the water industry by increasing public interest in water</li> <li>· The importance of water highlights creating new opportunities for the water market to expand</li> </ul>	<ul style="list-style-type: none"> <li>· Measures to secure sufficient budget for water management and to systematically train human resources</li> </ul>
<b>Threat</b>	<ul style="list-style-type: none"> <li>· Worsening water management conditions due to deepening climate crisis</li> <li>· Increased risk of stable water supply due to increased water demand</li> <li>· Greenhouse gas increase due to water usage</li> <li>· The deepening of the water-related conflict</li> </ul>	<ul style="list-style-type: none"> <li>· Measures for efficient operation of domestic water resources facilities and for securing additional water</li> <li>· Measures for water use reduction</li> <li>· How to build conflict resolution process</li> </ul>
<b>Strength</b>	<ul style="list-style-type: none"> <li>· Existence of excellent professionals in domestic water management</li> <li>· Technic and experience related to overcoming water disasters and stable water supply</li> </ul>	<ul style="list-style-type: none"> <li>· Measures to secure sufficient and to systematically train human resources</li> <li>· Maximize efficiency through interagency linkage</li> </ul>

weakness	<ul style="list-style-type: none"> <li>· Deterioration of dams and water facilities accelerates</li> <li>· Loss of acceptance due to lack of civic participation in the policy process</li> <li>· Inefficient results due to the division of labor of water-related institutions</li> <li>· Problems with planning and existing systems</li> </ul>	<ul style="list-style-type: none"> <li>· Promotion of replacement of facilities by securing budget</li> <li>· A plan for establishing water governance to increase citizen participation</li> <li>· Plan for interagency collaboration system and efficient operation system in the future</li> <li>· The direction of systematic planning</li> </ul>
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Specific problems related to water management in Korea were derived by considering the above factors in combination. On the basis of this, I would like to describe the research project and its specific methodology.

The first is the institutional aspect of water management and the inefficiency of organizational operations. The environmental conditions of water management in Korea are worsening. As climate change intensifies, the scale and duration of floods and droughts are beyond the predicted range (Bae & Heo, 2022). In this regard, it is necessary to first examine whether the composition and operation of water management institutions existing in Korea are systematically operated. Next, for practical integrated water management, it is necessary to improve the situation in which each facility is not organically linked and operates inefficiently. With the current water shortage and climate crisis accelerating, it is necessary to consider the better use of water resources.

Second, there are so many domestic water-related laws and plans that there is a problem of overlapping human resources, budget waste, and roles between plans. (Kim & Kim, 2019). There is also a lack of monitoring and evaluation of whether related plans are systematically implemented. The level of planning remains at a formal level because of the lack of expertise and personnel. Integrated water management must be systematically implemented from the planning stage. It will not be able to respond effectively to various water-related problems such as climate crisis or water shortage unless a plan is made that thoroughly considers regional

characteristics or circumstances.

Third, as the importance of water is strongly highlighted, social conflict is growing. Water is a mobility-shared resource that flows from upstream to downstream. If a specific area occupies water exclusively and enjoys benefits, it greatly hinders social equity and efficiency. In particular, intensifying regional variations in precipitation and insufficient water resources are intensifying conflicts between local governments over water security (Cha, 2014). In addition, in promoting water resource policies such as the four-river project, many social conflict costs occurred as opinions emphasizing water ecology and the environment and those emphasizing securing water resources were opposed. Accordingly, conflict resolution through governance has recently been emphasized to secure social acceptability and minimize conflict costs in policy promotion. Water governance is also linked to expanding civil society participation. Conflict and the expansion of civil participation are closely linked topics that need to be reviewed together. Among the issues in this capstone, I will discuss water governance and conflict resolution. The reason is that if the interests of civil society and experts are well reflected in the policy during the operation of the water policy system, and if various members are continuously and intensively involved in the water policy establishment and operation process, the inefficiency discussed later will be significantly improved.

Fourth, to support systematic water management, sufficient funds and personnel must be provided. However, many experts point out that budget projects that can apply the Framework Act on Water Management are very scarce or not reflected, and that the NWMC and policy development project budgets are also insufficient. As of 2021, the national water management research project budget is only 10 billion won (Environmental Daily, February 25, 2021).

For smooth water management, it is imperative to cultivate professional personnel and secure related budgets. Therefore, it is necessary to create an advanced and sustainable system

for the future. Moreover, it is essential to secure sufficient personnel and budgets to prepare for climate change-related problems and promote effective carbon-neutral measures.

In relation to Capstone's narrative structure, I would like to focus on governance and conflict resolution, which have recently become the most important issues in the operation of water management in Korea. I will explain why the concept of water governance, which has recently been in the spotlight, has recently emerged by referring to various studies analyzing the background, necessity, definition, problems, and stakeholders included in governance. Water conflict will be classified by type through various case analyses. On the basis of the analysis of the current situation in these areas, I want to suggest the direction of implementation.

The most important issue of this capstone is the direction that our water management should pursue, which is divided into four parts in the same context as the above problems. First, I would like to summarize the contents based on the matters discussed by various water experts and social issues related to institutional and organizational aspects, and draw conclusions based on personal work experience and opinions. Second, in terms of planning, I would like to present a desirable plan model through a foreign case analysis and comprehensively describe the various opinions I felt while discussing with working-level officials. In the Operation section, I present a desirable future image for our society based on various studies and my experiences as a practitioner of governance. In the Conflict Resolution section, I will focus on alternative dispute-solving methods and various foreign cases that are already being discussed in earnest in society. In the end, I plan to deal with the personnel and budget aspects. I will first describe the desirable direction of fostering labor. Next, in terms of budget, I will deal with the integration of local water supply facilities to improve inefficiency. Next, I will focus on the carbon tax, which is being discussed in various ways in foreign countries and other countries in response to climate change, from the perspective of rate hikes.

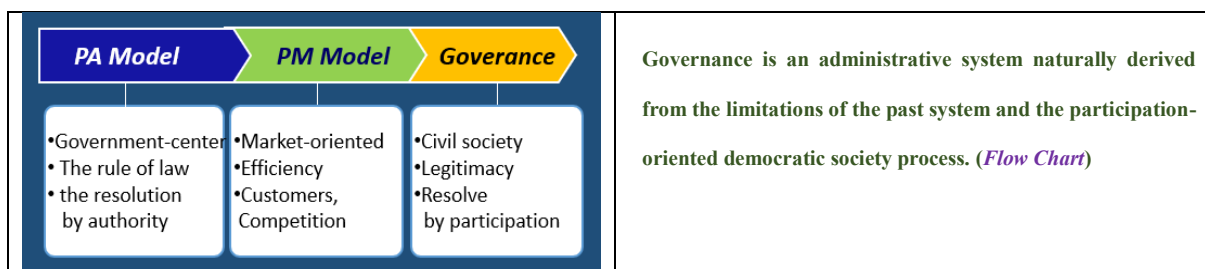
## II. As-Is analysis : Challenges in water resource management

### A. Water governance

#### 1 . Background

Policies surrounding water resources have been developed on the basis of the traditional administrative paradigm based on bureaucracy. The bureaucratic paradigm was created in the industrial era, and the market and civil society were alienated by the government-centered problem-solving process (PA Model). Since then, a new public management theory emerged in the 1970s. This theory was intended to provide better administrative services by introducing the efficiency of the private sector into the public sector. (PM Model). However, this theory emphasizes efficiency but does not consider procedural democracy and legitimacy through public support in the process. To compensate for these weaknesses, civil society other than the government, the market (enterprise), has emerged as an important element of administration, and governance has emerged as an alternative to new public policies. In other words, there has been an inherent limitation of the lack of communication and agreement with civil society in policy establishment and operation. It is important to form cooperative governance with the private sector to pursue a sustainable and rational decision-making structure for the country, going beyond administrative services based on vertical bureaucracy and efficiency (Kim, 2017).

[Figure 4] Background to the emergence of governance.



## ***2 . The need for water governance***

Analyzing what has been the greatest deficiency in the process of promoting various policies related to water, social consensus and public debate efforts have been lacking. Therefore, the problem of the four major rivers remains a bomb that can be reignited at any time. Contrary to the view that the dams of the four major rivers should be actively used to secure water resources, the confrontation between the view that dams should be removed or opened at all times for water ecology and water quality is still drifting without conclusion. In addition, in large cities such as Busan and Daegu, there has been virtually no smooth progress in all efforts to obtain water from other regions. Owing to opposition from local governments with respect to water resources, numerous methodologies have not been able to advance one step. Water is the most important resource for humans. Everyone wants to monopolize and craves a stable supply. However, it is also a limited resource. Now is the time for future-oriented efforts to cherish failures and adversity by re-evaluating past policy failures, exploring new goals or means, and reviewing various strategic options that can be improved because of failures and adversity (Lee & Paul, 2017). I think the most urgent thing among such efforts is the establishment and successful settlement of water governance. Thus, the Organization for Economic Cooperation and Development (OECD) Open Government Paradigm suggests that government transparency and accountability should be strengthened throughout the policy process and institutionalized citizen participation to build cooperative governance between government and citizens and use the engine of democracy and inclusive growth as a driving force for social capital and innovation growth (Lee, 2019).

## ***3 . Definition of water governance***

There are various definitions of water governance. There is an opinion that it refers to an

alternative management system for issues that are difficult to solve with existing governance or management systems based on mutual trust and sharing experiences and knowledge of each other in the process of forming a consensus among various stakeholders (Lee, 2014). There is also an opinion that emphasizes the increasing role of horizontal and voluntary networks composed of various partners such as the central government, local governments, civic groups, businesses, and ordinary citizens in solving problems that are difficult for government organizations to solve (Agranoff & McGuire, 2003). In the past, the government monopolized the expertise, information, and capabilities for problem solving, but in the complex modern society, the government's capabilities are limited. The private sector also has many capabilities, and this point became clear through the COVID-19 incident. The government also has limitations in accurately grasping social problems. However, this does not mean that the role of the government has been lost. To be precise, the role of the government is changing. In a network society, the government works as a catalyst for solving social problems through the cooperation of various members of society and creates the conditions necessary for solving social problems (Lee & Yoo, 2009). In these changes, the core of water governance is to introduce a system that allows many stakeholders to participate in and interact with the state's unilateral water management policy decisions. Specifically, it is an evolved administrative system that emphasizes the need for effective political, social, and administrative systems to introduce integrated water resource management, a clear legal framework, participation of various people, disclosure of information, fair evaluation systems, financial principles based on consumer and pollutant burden principles, and regional cooperation for water management in the basin (K-water. 2019).

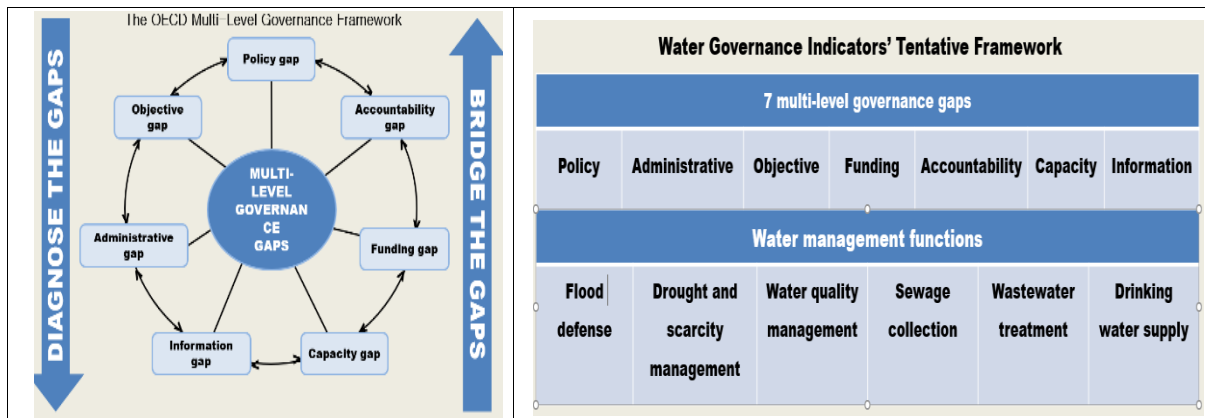
#### ***4 . Problems with water governance operations***

Korean governance is still in its infancy and still has many problems. The most important

issue is trust. In governance, trust is central to the formation and maintenance of partnerships among participants (Song, 2021). Trust is an invisible infrastructure that provides the basis for individual-to-person interactions. This is why so much governance in Korea faces limitations in its operations. In the end, the success or failure of governance operations leads to the question of how to increase trust among participants. Next, let us look at the specific prerequisites that must be met to solve these problems.

First, what is the ideal situation for water governance in Korea? There has been much discussion about this. In this regard, the 2003 UN World Water Report also points out that modern water problems stem from poor governance (Bakker, Karen, 2010). Specifically, it also mentions seven problems related to governance operations. These factors will be an important milestone for our governance to operate actively and efficiently in the future. If these areas are improved, more mature water governance can be formed.

[Figure 5] The OECD multi level governance framework (logic tree) (OECD)



**Table 2.** Seven problems related to governance operations

(OECD (2011), *Water governance in OECD: A multi-level approach*, OECD publishing, Paris)

**Problem**                      **Content**

**Responsibility gap**    It is necessary to induce the active participation of citizens and consequently ease the responsibility gap between the government, businesses, and civil society.



<b>Target gap</b>	Excessive competition between ministries led to organizational selfishness and a partition between organizations, as pointed out as the limitation of the PM model. It is necessary to create a government organization that combines and collaborates with each other for the same goal and expand it to civil society.
<b>Management gap</b>	Fragmentation between government departments should be mitigated. In that sense, organic organizations are more effective than mechanical organizations. Organic organizations have ambiguous classifications between departments, open environment, and flexible tasks and roles.
<b>Competency gap</b>	The efficiency of performance can be seen as directly related to continuous communication and education with residents. Through communication or education, residents' expertise and responsibility can also be increased.
<b>Information gap</b>	In the owner-agent model, the owner does not secure accountability because the owner lacks information than the agent. The moral hazard and opportunism or reverse selection of agents occurs using such an advantageous position (Kathleen M. Eisenhardt, 1989).
<b>Fiscal gap</b>	Sufficient financial resources must be secured to support governance. In particular, the financial situation of civic groups, one of the pillars of governance, is very poor. Accordingly, financial support is also needed to induce active participation of civil society
<b>Policy gap</b>	Clearly assign and distinguish roles and responsibilities in water policy making, implementation, operation management and regulation, and create cooperation plans between responsible authorities

### ***5. Analysis of participants in water governance***

The participants in water governance are, after all, all stakeholders related to domestic water management. In the end, this problem leads to the problem of determining who the stakeholders

are and what needs and characteristics they have.

Let us analyze the various stakeholders involved in water management. Through this, let us also look at the content of the relationship between stakeholders. The analysis of these factors will allow us to take a more strategic approach to the direction of governance operations.

Stakeholders here refer to victim and beneficiary groups that are negatively or positively affected by the adoption and implementation of policy alternatives (Nam, 2012). Major domestic stakeholders surrounding water management can be classified into the government, local governments, public institutions, expert groups, civic groups, and civil society in detail. In terms of water management, the government authorizes them, local governments and public institutions implement major policies, and expert groups participate in analysis and alternative decisions. Thus far, civic groups and civil society are at the limit of formal participation in the entire process.

**Table 3.** *Analysis of stakeholders related to domestic water management*

<b>Categorization</b>	<b>Detail</b>
<b>Central government</b>	Lead agenda setting and policy formation, influence policy making and decision making based on expertise and experience
<b>Local government</b>	Subjects who carry out regional policy enforcement participate in setting national agendas or forming policies for regional interests
<b>Public institutions</b>	Performing policy execution functions as a subject providing public services, but indirectly participating in the process of agenda setting or policy formation
<b>A group of experts</b>	Influence the policy process by presenting policy alternatives to solve problems or critically evaluating the policy's impact
<b>Non-governmental organizations(NGOs)</b>	Setting policy issues such as the environment on the agenda, and suggesting related policy alternatives

**Table 4.** *Analysis of stakeholder needs*

<b>Stakeholders</b>	<b>Needs</b>	<b>Problem</b>
<b>Central government</b>	smooth implementation of policy without conflict	Conflict-related laws and lack of dedicated organization
<b>Water-supply local government</b>	Securing exclusive rights to water in the area	Indifference to resolving water problems in other regions
<b>Water-benefits local government</b>	Securing required quantities, minimizing civil complaints	Lack of willingness to support local governments
<b>Citizen</b>	Securing a stable supply of clean water	Difficulty in securing objective data, limited expression of idea
<b>NGOs</b>	Reflecting what the group thinks in water policy	Financial difficulties, political color distinct

## ***6. Analysis of stakeholders' policy participation patterns***

Based on the characteristics and needs of stakeholders, it can be subdivided into five stages according to the stakeholder participation spectrum (Kim & Bae, 2022).

**Table 5.** *Categorizing steps based on stakeholder engagement spectrum*

<b>Stage</b>	<b>Detail</b>
<b>Inform</b>	<b>Provides balanced and objective information</b> to help stakeholders understand problems, responses, and solutions
<b>Consult</b>	<b>Getting input from stakeholders</b> in analysis, alternatives and decisions
<b>Involve</b>	<b>Consistent consideration of stakeholder interests</b> , etc., by working directly with stakeholders in the overall process
<b>Collaborate</b>	<b>Partnering with stakeholders in all aspects of decision making</b> , including alternatives or preferred solutions
<b>Empower</b>	<b>Composed of stakeholders making final decisions</b>

Nevertheless, the government is leading the formation of overall governance and policy execution by taking the lead in water policy. On the other hand, civic and expert groups play a major role in providing information to citizens, but they play a secondary role in other participatory aspects. Moreover, in the role of providing information, in the past, data was accumulated in the government or public institutions, making it difficult for civic groups to perform their activities. Recent active discussions on the opening of public data and government communication are expected to improve this aspect and contribute to the expansion of civic groups' role in the future. It is also expected that it may combine with the information of the private sector to create synergy in establishing water policies.

**Table 6.** Key configurations based on stakeholder participation spectrum

Stage	Inform	Consult	Involve	Collaborate	Empower
<b>Government</b>	●	●	●	●	●
<b>Local governments</b>	●	●	●	●	●
<b>Public institutions</b>	●	●	●	●	
<b>Expert groups</b>	●	●	●	●	
<b>Civic groups (NGOs)</b>	●	●	●	●	
<b>Civil society</b>	●				

Configurations based on participation spectrum by stakeholder (major ●, incidental ●)

## **7. Analysis of water governance in Korea**

Currently, there are many committees in operation regarding water governance, but the NWMC is a representative governance body that has recently emerged in relation to the efficient operation of water systems. The National Water Management Committee was

launched in 2019 as an organization that deliberates and decides important matters related to water management. Academia, civic groups, research institutes, lawyers, industrial organizations, and residents' representatives participate in the private sector, and virtually all stakeholders related to water participate. Of course, the participation of resident representatives here is still limited to a small number due to the limited expertise of their staff.

**Table 7.** *Form of water management committee (K-water, 2019, p.241)*

<b>Division</b>	<b>National water management committee</b>	<b>Watershed management committee</b>
<b>Chairperson</b>	Prime minister One private person (appointed by the President in an academic or organization)	Minister of MoE One private person (appointed by the President in an academic or organization)
<b>Official member</b>	Minister of Water (Minister of MoE, Minister of MoLIT, Minister of MoIS, etc.)	Governor, Head of Basin Environmental Office, Director of Flood Control, Director of Local Land Management, etc
<b>Public institution</b>	Head of the KHNP, K-water, KR, KE	Executive of the KHNP, K-water, KR, KE
<b>Private sector</b>	More than an associate professor in the field of water management / A person who has worked in a water organization or institution for more than ten years / A judge, prosecutor and lawyer who has served for more than ten years / A person with social trust and knowledge experience	

**Table 8.** *Status of civilian members of the NWMC (1st term)*

<b>Division</b>	<b>Detail</b>
<b>Han River</b>	A total of 22 (academic 8, civic groups 5, research institutes 4, lawyers 3, industry 1, resident representative 1)
<b>Nakdonggang River</b>	A total of 23 (academic 10, civic groups 5, research institutes 2, lawyers 2, industry 2, resident representative 2)
<b>Geumgang River</b>	A total of 22 (academic 10, civic groups 3, research institutes 3,

	lawyers 3, industry 2, resident representative 2)
<b>Yeongsangang Seomjingang River</b>	A total of 19 (academic 9, civic groups 3, lawyers 2, industry 3, resident representative 2)

To realize practical governance and expand the range of communication, the participation of residents should be further expanded (Lim, 2005). However, there is a concern about whether it is appropriate to involve citizens who lack expertise in important decision-making fields. If so, it is also necessary to consider how to participate.

Currently, most water-related governance is operated by the MoE. This is because major water governance has also been transferred to the Ministry of Environment because of the unification of water management. In addition, local governments and public institutions also operate governance by means of collecting opinions and consulting.

**Table 9.** *Current status of major water governance in Korea*

<b>Division</b>	<b>Detail</b>
<i>National Water Resources Management Committee</i>	Deliberation and consultation on matters concerning national water resource policy, such as the establishment and change of water resource plan 15 public officials including the Vice Minister of MoE, 17 academics and experts, 4 civic groups, 7 industries, and 8 public institutions
<i>Central Environmental Policy Committee</i>	Deliberation on major environmental policies and plans, such as the National Environmental Comprehensive Plan 7 public officials including the Minister of MoE, 56 academics, 22 civic groups, 19 industries, and 24 public institutions
<i>Hydrophilic Zone Development Committee</i>	Review and deliberate on matters concerning the designation and modification of hydrophilic areas, formulation and modification of implementation plans, implementation of projects, operation of funds, etc

	7 public officials including the Minister of MoE, 10 educators, and 8 professionals,
<i>Central Environmental Dispute Mediation Committee</i>	Coordination of environmental disputes, investigation and counseling of civil complaints related to environmental damage, research and suggestion of systems and policies for the prevention and resolution of disputes, etc Chairman of the Central Environmental Dispute Mediation Committee, 19 educators, and 10 professionals
<i>Watershed Management Committee</i>	Comprehensive plan for reducing pollutants to improve water quality, matters concerning the operation and management of the water management fund, formulation of a basic plan for the management of waterfront areas, etc (Kumgang) Vice Minister of MoE, Senior Public Officials Related to MoLIT, Korea Forest Service(KFS), Deputy Governor of five cities and provinces (Daejeon, Sejong, Chungbuk, Chungnam, Jeonbuk), President of KR, President of K-water * The Advisory Committee consists of 20 representatives of five provinces, civil organizations and industry

## ***B. Water conflict resolution system***

### ***1. Definition of conflict and conflict resolution principles***

Here, we will discuss the issue of public conflict in detail. Public conflicts are defined as conflicts and disputes arising from conflicts of interest between public institutions and citizens or public institutions in the process of implementing policies, laws, and projects that affect the rights and obligations of the people (Kim, 2019).

From an interactive view of conflict, conflict is essential for change and innovation. It can promote creative thinking and improve the logical system for social progress. The problem is

that conflicts that go beyond the adjustable level within society have a negative impact on society. An increase in a country's social conflict index directly leads to a decrease in per capita GDP and negatively affects the economy (Jung & Ko, 2014). It also causes many problems, such as lowering the trust of the government. To solve the problem of these public conflicts, the government enacted regulations on conflict prevention and resolution of public institutions and established related organizations. In addition, the relevant regulations emphasize the five principles of conflict management at the government level. However, conflicts over water, such as life, are so acute that it is difficult to comply with these principles. Nevertheless, if conflict resolution is achieved without these principles by authority or coercion, it seems to have been resolved immediately, but it will remain a new social problem as it is latent afterwards. Therefore, it is necessary to establish a conflict system based on the following principles.

**Table 10.** *Basic principles for conflict resolution in conflict regulations*  
*(Regulations on conflict prevention and resolution of public institutions)*

<b>Principle</b>	<b>Content</b>
<b>Self-resolution and securing Trust</b>	Emphasize the formation of autonomous consensus based on trust between stakeholders
<b>Participation and procedural definition</b>	<b>A fair process</b> must be established for stakeholders to accept and participate in
<b>Comparison of profits</b>	The principle that the profits generated by government policies must be greater than the losses resulting from them
<b>Disclosure and sharing of information</b>	Provide transparent and objective information to encourage stakeholder participation and cooperation
<b>Consider sustainable development</b>	Consideration of ecological and environmental aspects is needed rather than being buried in government policy

## ***2. Causes and forms of conflict***

Water is a finite resource., and its importance has been emphasized over time. As a result,



various conflicts over water are emerging around us. Water conflict occurs in the process of establishing and implementing policies or business plans related to water or in the process of managing or operating facilities. This process refers to all activities carried out to prevent or resolve conflicts of values and interests among the state, local governments, public institutions, and other related groups. When the type of conflict is classified, it can be divided into profit conflict and value conflict depending on the cause of the conflict. However, complex conflicts of interest and value conflict exist. Conflicts of interest arise when competing for limited resources or power or having different positions on profit distribution methods. Value conflicts can be defined as conflicts caused by differences in values, belief systems, religion, and culture (Kim, 2019, p.26). Domestic water disputes are common to conflict with several different forms of interest.

**Table 11.** *Various types of domestic water conflict*

<b>Category</b>	<b>Content</b>	<b>Case</b>
<b>Policy conflict</b>	Emphasis on the environment such as aquatic ecology vs. Development for the use of water resources	The Four Rivers Project, Controversy over the opening of dams on the Four Rivers
<b>Regional conflict</b>	Conflict to secure clear water and stable quantity	Conflict in the process of bringing water from nearby areas from large cities such as Daegu and Busan, where water quality is poor
<b>Conflict between the upper and lower streams</b>	Environmental regulations infringe on the property rights of upstream residents and impose water usage charges on downstream residents	A movement to remove regulations from upstream residents, demand additional government support, and refuse to pay levies for

		downstream residents
<b>Conflict over infringement of property rights</b>	Damage due to insufficient flow rate in the downstream area due to excessive intake in the upstream area, etc	Salt damage caused by reduced flow rates downstream of the Seomjin river

There are also various aspects of conflict. Similar to Ulsan’s Bangudae Petroglyphs, conflicts exist between the state (Cultural Heritage Administration) and local governments (Ulsan Metropolitan City), between local residents and the state, and between companies and local residents. However, what accounts for the majority will be regional conflicts over water intake sources. Moreover, the pattern of drought, which is further accelerated by climate change, could lead to future water shortages. In this situation, each local government insists on securing water autonomy and intends to exercise damage due to insufficient flow rate in the downstream area due to excessive intake in the upstream area, exclusive rights to water use in the region. However, from a national perspective, it is not desirable for individual local governments to monopolize water resources in the region. A primary method for efficiently allocating and managing resources at the watershed level should be developed. In this process, conflicts between regions will occur more frequently in the future. Accordingly, it is essential to establish a conflict resolution process in response to the predicted social conflict. Traditional public conflict management measures such as lawsuits take a long time to resolve. In addition, there is a high risk of continuing confrontation and re-enacting disputes even after litigation.

### **III. To-Be analysis : Alternatives to water resource management**

#### ***A. Direction of improvements***

First, an institutional system must be well established as an element for Korea’s water management and be equipped for further advancement. It is necessary to reorganize an efficient

system that can respond quickly to the current climate crisis or lack of water demand. In addition, it will be inevitable to eliminate inefficiency caused by the segmented work system between institutions, improve the communication system between institutions, and coordinate or integrate business areas between institutions centered on the control tower in the future. In terms of planning, it is necessary to change the direction that fits the paradigm of integrated product management, and in the process, it is necessary to consider the process of simplifying and integrating the scattered plans. On the operational side, it is necessary to approach it from the perspective of social acceptance. Owing to the failure of social compromises in the operation of water management, many plans and implementation tasks have existed only on paper. Efforts to minimize conflicts between stakeholders in advance through water governance should be conducted. If a conflict situation arises because of the failure to reach a consensus in the governance process, the system should be upgraded to incur minimal social costs by considering the water conflict resolution process as the next best option. Finally, for water management to achieve sustainable development and growth, it is necessary to foster specialized personnel and provide sufficient budget support. In terms of efficiency, social acceptance and sustainability, I want to suggest a plan for future water management.

## ***B. Institutional/organizational improvements***

### ***1. Institutional improvements***

In terms of water crisis and water security, integrated water management has emerged as a new water management paradigm to overcome water problems (Na, 2015).

This means managing water at the watershed level through a consensus process among stakeholders to maximize the synergy effect in terms of efficiency, fairness, and sustainability by integrating the entire watershed into one organism. In Korea, efforts such as integrated water

management were confirmed in 2017 and the Government Organization Act was revised (2018). Accordingly, MoLIT's water-related work was gradually transferred to MoE. However, significant institutional improvement efforts are still needed for more advanced forms of integrated water management.

First, new dams need to be built in preparation for extreme drought and flooding caused by climate change to become commonplace. Currently, it is difficult for Korea to cope with the increasing demand for water using existing dams alone. Considering climate change, the water shortage is 2.2 to 2.4 times higher than the national water management plan, and the phenomenon is expected to intensify in the future. (Results of Audit and Inspection on Adaptation and Response to Climate Crisis ('23.8) Accordingly, discussions on the construction of new dams should continue on the basis of collecting and publicizing local opinions. To reduce the damage to residents in surrounding areas caused by the construction of dams, institutional support for improving settlement conditions and state budget support for tourism resources are also needed.

Second, it is necessary to supplement existing dams. Due to climate change, precipitation and flood volume have increased. On the other hand, the dam is aging, and the water supply capacity and storage capacity continue to decrease over time because of the sedimentary soil. Accordingly, it is necessary to expand the function of the dam by constructing additional auxiliary dams upstream or to increase the height of the dam to increase the water supply and storage capacities. In addition, additional storage capacity should be secured by dredging sedimentary soil in the dam (Cha, 2023). Therefore, it is necessary to establish an institutional plan to regularly establish countermeasures by comparing the water supply capacity of the dam with the required amount of water.

Third, there is a need for research on how to make the most of the unused or underutilized

water resource facilities. For example, unused dams among KR, KHN, and local government dams in Korea can be converted into a database to promote operation in connection with multipurpose dams or to maximize utilization by improving facilities. For example, the Doam Dam owned by KHNP has been suspended since 2001 because of complaints about water pollution. Using dams can improve the conditions of water quality problems in the East Sea of the Han River. The local community and related organizations decided to conduct research services on rational water use to mediate the Doam Dam conflict to solve the problem (MBC News, 2022, 12, 1). In addition, cooperation between agencies should be strengthened to maximize the utilization of dams. Institutional measures should be prepared to set various functions such as flood control, power generation, and water supply functions within one dam, as in the case of the Seomjingang Dam. In Japan, the utilization of the Sakuma Dam, a hydraulic dam, has been maximized by the state purchasing some supplies for flood control functions. Multipurpose dam conversion is a global trend and more social benefits can be secured through the conversion of multi-purpose dams.

Fourth, in line with the trend of developed countries, it is necessary to convert a single-purpose dam into a multipurpose dam in preparation for climate change and water shortage. Korea is also discussing the conversion of agricultural reservoirs or power generation-only dams into multipurpose dams, but various problems exist, and it is time to consider solutions more seriously. Fortunately, in the case of the Han River water-based power generation dam, attempts to use it for multi-purpose dams such as the supply of living and industrial water and drought and flood response began in 2020. The Han River Flood Control Station under the MoE and the KHNP under the MoTIE agreed to improve water management and signed an agreement for the multipurpose use of the Han River water-based power generation dam as part of integrated water management in preparation for climate change. Through this, it is expected to respond more smoothly to future water demand and climate change (Water Journal,

May 7, 2020). Furthermore, the water from agricultural reservoirs is planned to be used for other purposes, such as living and industrial water, in addition to agricultural purposes. In addition, measures to use abolished reservoirs for multiple purposes, such as storing water in preparation for flood occurrence and supplying environmental ecological water, are under discussion. However, there are many challenges to this end, such as establishing a legal and institutional basis for establishing the right to use water, repairing the facility, resolving farmers' concerns, and solving the problem of setting up a water source protection zone due to the supply of living and industrial water. Finally, in preparation for climate change, measures to use dams installed in the four major rivers should also be discussed. Alternative supply of dam water supplied to the water intake and water pumping stations downstream of the dam could also be discussed.

## ***2. Organizational improvements***

In Korea, there are various water-related institutions but they are currently mixed up and disorganized. This complexity in the water management system has resulted in inefficiencies. It is important to assess if the current system is the most optimal structure for water management. In addition, simplification of the complex system should be considered. Public institutions responsible for water management include government agencies such as MoE, NWMC, K-water, KE, KR, KHNP, research institutes such as Korea Environment Research Institute, and local governments. This complex system creates confusion and can hinder decision-making and implementation.

**Table 12.** *Current status of water-related institutions and overlapping cases*

<b>Government</b>	<b>Public enterprise</b>	<b>Main role</b>
MoE	· K-water ·	· Operation and management of water resource facilities such as multi-purpose dams, flood control dams, and water-only dams

		<ul style="list-style-type: none"> <li>· Operation and management of wide area water supply and industrial water supply</li> <li>· Water supply services such as local water supply operation efficiency project, improvement of water supply pipes and double-tracking</li> </ul>
	· KE	<ul style="list-style-type: none"> <li>· Establishment of integrated sewage management system for basin unit</li> <li>· Improvement of water quality in key management areas</li> <li>· Management of sewage maintenance major areas for urban flooding</li> <li>· Modernization of sewage treatment plant</li> </ul>
MAFRA	· KR	<ul style="list-style-type: none"> <li>· Management of agricultural infrastructure such as agricultural dams to improve agricultural farming and agricultural productivity of farmers</li> <li>· Improvement of water quality for reservoirs in agricultural dams, repair and reinforcement of facilities</li> </ul>
MoTIE	· KHNP	<ul style="list-style-type: none"> <li>· Operation and management of hydroelectric power generation facilities such as hydroelectric dams</li> </ul>
MoIS	· KHNP	<ul style="list-style-type: none"> <li>· Small river management</li> <li>· Measures for disasters such as flood</li> <li>· Construction of local water supply and Local sewage treatment facilities</li> </ul>

< *Water management inefficiencies and overlapping cases* >

- The MoE and local governments have implemented ecological river restoration projects and small river maintenance pilot projects, respectively, for local and small rivers (Kim, 2012).
- Despite the lack of living water, the KR stockpiles agricultural water for the farming season, and KHNP is discharged into the sea after using water for power generation.
- Case where the MoE's investment in wide area water supply and the local government's investment in local water supply are overlapped and one of the facilities is not properly used.

**Figure 6.** Dam management status by institution



Note. K-water (Left), KR (Middle), KHNP (Right)]

There are instances where roles may overlap or be unclear. If there is a conflict of interest, it can result in harm to individuals while attempting to maximize the interests of the institution

it represents. For example, KR may have to continuously oppose the conversion of agricultural dams to drinking water supply as it may not be in the best interest of farmers. Similarly, KHNP may not be equipped to handle drought and flood responses as it primarily focuses on electricity generation. From a national perspective, the current organizational system may not be able to handle disaster response and electricity generation in a balanced manner. Therefore, it is necessary to integrate mutual agencies or have state agencies serve as control towers to effectively manage all organizations.

**Table 13.** *Stakeholders related to integration and improvement between water institutions*

<b>Stakeholders</b>	<b>Needs</b>	<b>Problem</b>
<b>MoE</b>	Smooth promotion of national water management centered on the MoE based on the integrated water management system	Lack of measures to overcome opposition and concerns of other administrative agencies or local governments
<b>Other administrative agencies (MAFRA, MoIS, MoTIE)</b> <b>public institution</b>	Hoping to maintain the current system due to concerns over reduction of organization and work area	Lack of willingness to cooperate with each other to improve climate change or water quality, and passive management of integrated products
<b>Local government</b>	Maintaining the current system due to concerns about shrinking organizations and budgets and loss of sovereignty over water	Lack of awareness of water management from a national perspective and passive resolution of water problems

As previously mentioned, the policy process consists of several stages, including agenda setting, policy formation, policy execution, policy evaluation, and policy change. The government agencies responsible for playing a significant role in this process are the MoE and



the NWMC. It is essential to establish a clear distinction between the roles of these two institutions. The MoE should be the center of national water management, leading the agenda setting and policy formation processes. To strengthen the cooperation system with other government agencies such as the MAFRA, which manages agricultural water, it should have a permanent communication network. On the other hand, the NWMC should primarily focus on conflict resolution and policy evaluation. While the committee may participate in setting an agenda or forming a policy, it should avoid overlapping roles with the MoE to prevent inefficiency. Evaluating policies about water management is crucial and should be the basis for policy learning and change through policy feedback. Unfortunately, there is no dedicated organization in Korea for evaluating water management policies. Therefore, the NWMC should lead the role in providing feedback throughout the policy process. In particular, experts and civil society must have their voices properly conveyed during the policy formation and enforcement stages.

Policy execution is a very complex field that can be difficult to manage efficiently. For instance, in 2016, the government announced a policy to entrust the operation of power generation dams operated by KHNP to the K-water (Yang, 2018). The aim was to efficiently manage water resources, as the importance of water management, such as drought and flood, has increased while the importance of hydroelectric power generation has decreased. However, the implementation of this policy has been slow and has faced opposition from internal members. The issue is related to the survival of each institution, and there are many different factors, such as the form of organization, culture, and operation of each institution, that make rapid combination difficult and increase inefficiency and internal conflict.

It is true that water management agencies have not communicated effectively with each other for a long time. However, to respond efficiently to the water crisis caused by increasing

uncertainty in the future, collaboration between agencies must be strengthened in the short term. In the long run, institutional integration must be strengthened as well. This is evident from the damage caused by heavy rain in the Seomjingang Dam and Yongdam Dam areas in August 2020 (Cho, 2020). To prevent such damage, the Meteorological Administration that predicts torrential rain, local governments that manage the embankment of local rivers, and dam management agencies must cooperate organically. In case of a crisis, there should be discussions on how to communicate with each other and manuals should be created. For example, during a severe drought, it is necessary to prevent water from flowing out of a hydroelectric dam into the sea for power generation. Thus, consensus must be strengthened among the agencies. After the incident, instead of focusing on the issue of responsibility, institutions should exchange each other's response systems in advance and exchange opinions on how to respond well to the water crisis. The growth of each institution can be achieved in terms of technology and institutions. The integrated water management council that was launched in 2020 is expected to play a key role in this regard.

Nine water-related organizations, including the K-water and the KR, have joined the Integrated Water Management Council led by the NWMC. The aim of this council is to share research progress and identify joint tasks that can have a synergistic effect on integrated water management policy research. They have also decided to respond to droughts and floods by sharing facility location information and setting the limited water level of dams in case of flooding in solidarity with each other (The Water Journal, April 7, 2021). To consistently respond to disasters such as drought and flood, it is necessary to prioritize the integration of information and regular consultation between agencies, centering on the Integrated Water Management Council. Developed countries have specific guidelines for climate change, but in Korea, institutional aspects such as related laws and regulations are insufficient. In the future, the Ministry of Environment, among various government ministries, should play a central role

in national water management in line with the purpose of unifying water management.

It is a wise decision for the K-water, a public institution under the MoE with extensive capabilities and expertise in water management, to play a leading role in water management. As a specialized water agency with over 50 years of experience, the corporation has achieved significant milestones in water management, production, supply, and maintenance of tap water. It is crucial to approach future water management from the perspective of integrated water management, considering the distribution of all water and the welfare of the entire population, rather than individual purposes such as agricultural water, domestic water, and power supply. Given the organization's size, water management expertise, and integrated water management capabilities, it is essential to integrate institutions to improve efficiency and expertise by consolidating all domestic water management capabilities in one place. As foreign water companies' competition is inevitable in the future, such integration is meaningful. The K-water a management system for the entire water cycle, from rivers to water and sewage, and management capabilities for overall water quality and quantity. It also operates the National Drought Information Analysis Center and the National Underground Water Center and has an information system related to water management (Lee, 2023).

**Table 14.** *Efficient organization structure*

<b>Division</b>	<b>Agenda setting</b>	<b>Policy formation</b>	<b>Policy execution</b>	<b>Policy evaluation</b>	<b>Policy change</b>
<b>Short-term</b>	Form a consultative body with each government agency centered on MoE		Public enterprise council, Local government	NWMC	
<b>Long-term</b>	Water-related functions need to be unified by the MoE		K-water, Local government		

In the short term, it is important to establish inter-agency linkages and cooperation mechanisms to improve water management. In the mid to long-term, the focus should be on simplifying water management by integrating various agencies. Therefore, it is crucial to prioritize securing a consensus between agencies involved in water management and minimizing any conflicting interests.

### ***C. Planning/operational improvements***

#### ***1. Planning improvements***

As of 2019, there are 29 laws and about 97 plans under the law. The MoE is working on a plan to overhaul 97 water-related mandated plans to ensure efficiency, consistency and speed of water-related plans. Here, in order to increase the efficiency of policy implementation, each law must be organically linked. In addition, plans under the law must have systematic connectivity without mutual overlap. However, these matters are not systematically carried out in the large framework of integrated water management at presently. The hierarchy between water management plans is unclear and similar contents are repeated. This leads to a waste of manpower and budget. Overall, inefficiency in water-related administrative work occurs (MoE, 2020). First, there are cases where the management entity and the planning entity are different. For example, most of the groundwater usage is used as agricultural water managed by the MAFRA. However, the basic plan for groundwater management is established by the MoE, which is in charge of the Groundwater Act. As a result, the efficiency of groundwater-related policies is decreasing.

Second, there are cases where the application period of the higher plan and the lower plan is inconsistent. Third, the establishment procedure for water-related plans is stipulated differently by law. For example, some water-related plans do not include procedures for collecting

opinions or consulting stakeholders, or do not stipulate the obligation to notify, so they are not open to the public (Kim & Kim, 2019. 8). Fourth, local governments are always burdened by too many plans. In a lack of sufficient budget and professional manpower, local governments are forced to remain at a formal level in establishing and implementing plans. As a practical action plan felt by the people, the plan established by local governments is the most important. Accordingly, the local government's water management plan should be established in detail in consideration of the characteristics and topography of the region. As it stands, it faces limitations in effectively improving the quality of life of the people from the planning stage of water management.

The improvement plan for the above problem and the development plan of the water-related plan are described as follows. Most fundamentally, it should be linked to urban planning. The interconnection between all plans should be strengthened. For example, the first flood in 80 years in Seoul in 2022 caused various accidents and casualties such as road flooding, power outages, and leaks. In order to adapt to such climate change, a water management response system must be established to minimize urban flooding when floods occur in cities (Kim, 2023). In foreign cases, in the case of Chicago, flood preparation was always selected as a key issue in urban planning. Accordingly, in water management, in order to minimize damage in case of heavy rain, the emphasis was placed on planning to prepare for extreme rainfall by selecting flood-prone areas in the city. In addition, plans were established to improve the drainage system of the road pavement and to adapt to rainfall such as landscaping close to nature, storage areas, ecological wetlands, and rainwater gardens. This greatly contributed to the smooth circulation of water resources.

Philadelphia is also promoting application plans for green infrastructure, including wetlands with vegetation and green roofs, with a focus on heavy rain management. Furthermore, the city

is preparing to adapt to climate change from the planning stage by utilizing techniques such as river passage restoration and preservation, water treatment plant improvement, roof greening, rainwater gardens, and wetlands (Lee & Kim, 2014).

The biggest problem with domestic planning is that there are many exaggerations and errors from the basic assumptions, which do not produce substantial effects. For example, the most important factor in developing a water management plan is population estimation. However, local governments overestimate the population. The reason is, first, to facilitate the attraction of new developments. Second, to lay the foundation for receiving support from the central government for the installation of infrastructure (Kang & Kim, 2017).

If the population based on the urban plan established by the local government is applied to various water management plans, it will result in overpopulation calculation, resulting in overcapacity. In spite of the low utilization rate, the burden is passed on to the people, who are end consumers, due to the increase in rates due to excessive facility investment costs. In order to solve this problem, basic data such as population should be analyzed and prepared by the National Statistical Office rather than estimating the data on their own through individual services. If there is a problem, the National Statistical Office should focus on its efforts to further advance its population data analysis. Estimating the population for each individual service is an act of wasting excessive budget and manpower. In the future, when establishing all major national plans, common basic data such as population should be carefully verified by specific agencies such as the National Statistical Office, and inefficiency should be improved.

Local governments should improve their water management plans. Firstly, local governments require more autonomy as uniform planning will be meaningless. Each local government has different geographical and social conditions, and structures. Therefore, to have efficient water management, it is necessary to examine the unique topographical characteristics

of each local government. For example, it is necessary to first examine the unique topographical characteristics of local governments. Unlike foreign cities with flat terrain such as Tokyo, Paris, and London, most of Korea's land is made up of mountainous areas. Frequent flooding of cities lies in the fact that they have accepted the water management method of advanced overseas cities without criticism. Local governments with many mountainous areas should first consider ways to manage water in the mountainous area (Water Journal, March 5, 2021).

Secondly, local governments may have budget and manpower limitations which may hinder the establishment of water-related plans. The central government should not ignore this situation. Excessive planning obligations imposed on local governments should be eased. The plans prescribed by law must be separately designated so that the central government is obligated to establish them in consultation with experts. Most of what is currently mandated is causing excessive administrative waste. Plans that do not need to be mandated should be left purely to the autonomy of local governments. If the mandated plan is not established, penalties should be given, or local governments should be supported financially or with manpower to establish the plan.

## ***2. Operational improvements***

### ***1) Efficient construction of water governance***

#### ***(1) Suggestions for direction of stakeholders' policy participation patterns***

To improve the fairness and effectiveness of policy-making processes, expanding the scope of policy participation beyond government officials is necessary. This can be achieved by including expert groups, civic groups, and civil society in the policy-making process. Providing

specific and detailed information to citizens is essential for this goal. For expert groups, opportunities for participation and communication should be given throughout the entire policy process. Collaboration should be strengthened to develop effective and reliable policies that reflect citizens' opinions.

However, regarding civic groups, several issues need to be addressed. Civic groups often suffer from problems of overrepresentation and owner-agent. In the current situation, where views of society or phenomena are clearly distinguished by civil society, the problem of overrepresentation will inevitably arise if only a few specific civic groups are heard among many existing civil societies. Furthermore, while interest groups collect opinions from members on matters related to profits, civic groups lack such a process. Additionally, there is no supervision or monitoring function for civic groups.

There are currently over 10,000 civic groups in Korea, which is considered the pinnacle of civic group activity. However, civic groups themselves believe that they are in crisis. Critics have pointed out that some of the representative groups lack citizen involvement and operate like department stores. Additionally, there are concerns regarding morality and social responsibility (Kum, 2015).

To ensure that civic groups play a central role in water governance, certain measures must be taken. Firstly, it is important to strengthen the network of experts for productive discussions within civil society. Communication channels with citizens should also be expanded. Furthermore, the process of consensus among civic group members should be transparent. This will ensure that citizens are adequately represented. Therefore, it is important to consider which civic groups will participate in the construction of water governance, such as the Commission. The government must establish an analytical framework that considers factors such as how much civic groups attempt to collect civic opinions, whether the proceedings are transparent,



and whether they possess the necessary expertise, ability, fairness, and neutrality.

There is a limit to how well civic groups can gather citizens' opinions, even if they actively participate. Efforts are needed to make up for this. In the short term, public institutions should provide verified information to help civic groups and citizens make informed decisions. This will help strengthen society's ability to manage water-related issues. Objective water-related data should be made available on websites, and opinions should be actively collected through public hearings and meetings (Kim&Bae, 2022). In the mid to long term, civil society's participation in policymaking should be expanded. For example, a novel attempt has been made to operate a civic group formed in connection with recent nuclear issues. The group objectively selects large-scale citizens, taking into account factors such as age, gender, income level, and representation suitability. More sophisticated standards are needed to ensure that the selected person can represent the group effectively. In summary, to advance the water management system, the input process must be improved. For efficient water governance, citizen representatives and experts must be included in governance, and competency and information gaps between stakeholders, including civil society, must be minimized.

## ***(2) The role of water governance and improvement plan***

The policy process generally consists of agenda setting, policy formation, policy execution, policy evaluation, and policy change (Keun, 2012). After analyzing various committees under the MoE, it was found that most of the domestic water management governance is focused on policy formation and policy execution. The NWMC and the Central Environmental Policy Committee are responsible for policy formation, while the Hydrophilic Zone Creation Committee, the Water Management Committee, and the Water Quality Management Council are responsible for policy formation and policy execution. However, the role of governance in

policy evaluation and analysis is relatively weak. There are no established processes for conflict resolution related to water management, even though conflicts are expected to increase in the future. The NWMC is only responsible for evaluating the implementation status of the national plan and overall water management. Therefore, it is necessary to specify how feedback should be given after the evaluation and what parts of the evaluation require correction or monitoring of progress. To conduct policy evaluation smoothly, the National Water Management Committee needs to be given strong powers, such as the right to investigate requests for related data or the attendance of the person in charge (K-water, 2019, pp.276-277). A variety of factors should verify the output in Korea's water management system and give feedback on how to improve it more effectively. Civil society and expert groups can play this role, but the NWMC should collect opinions from various stakeholders in a systematic governance approach, have a strong influence, and lead active feedback policy reflection.

### ***(3) Measures to expand participation in governance in civil society***

In terms of civil society's involvement in governance, it may be challenging for them to participate in the post-execution phase of policies due to the lack of expertise. However, it is expected that they can actively participate in the policy formation or agenda-setting stage. To achieve practical governance and broaden the scope of communication, the participation of residents needs to be expanded. To do this, the information gap should be lessened, and experts or policy managers should provide support, such as educating citizens. In the future, we need to consider more deeply how to better incorporate the opinions of citizens into significant decisions related to water. To support civil society's participation in policy, I will outline the government's short, medium, and long-term objectives.

In the short term, various efforts should be made to provide information and knowledge and

induce interest in resolving civil society's indifference to water problems. If the information gap related to information asymmetry between the public and the private sector is large, the success of water governance is impossible. It is necessary to revitalize participation and narrow the information gap through continuous information sharing. In addition, the effectiveness of government policies can be maximized only when citizens' interest increases, and it will be easy to secure human and material resources related to water. It is also a good idea to strengthen the capabilities of civil society through recent water education or water-related discussions. It should also further study how to create high-quality data that people are interested in and easily accessible to. As one of the most urgent tasks, it is necessary to establish a platform where all water information is gathered. Recently, efforts are being made to provide individual water-related data to the public, but in the future, all water-related data should be collected, processed secondly, and a system for communicating with each other should be established. Data managed individually by local governments and public institutions should be collected as one. Disclosure of such data does not satisfy the public's right to know. It is necessary to go one step further and explain the information so that the public can understand it (K-water ,2014). In addition to providing simple information, the provision of services should also be improved so that all citizens can use it conveniently. The "23 Comprehensive Plan for Government Innovation" also emphasizes that the purpose and responsibility of the government and public institutions are to communicate with the people and solve problems quickly. Furthermore, through technological innovation, the level of reinforcement of accessibility and convenience should be innovatively improved by incorporating big data, cloud, and artificial intelligence into information and service provision.

It would also be a good idea to create a large single-water platform with the National Water Management Committee at the center. In addition to data, various reports and knowledge-sharing materials should be posted on the platform, and the process of freely communicating

with the people as an interactive platform should be implemented to produce, re-spread, and find answers through mutual discussions. For the disclosure of water information and transparent administration, it is also a good idea to broadcast the committee's discussion process in real-time through YouTube or various online channels or disclose it to the public. Through these channels, citizens will have more confidence in water-related policies.

Previously, it was mentioned that the biggest problem with Korean governance is the trust problem between participants. In governance, trust should be centered in the process of forming and maintaining cooperative relationships between participants. The smooth operation of governance will lead directly to a question of how to enhance trust among participants. Unlike the United States and Europe, where potential fair game laws have been internalized for hundreds of years, it has been argued that Korea lacks administrative consistency or fairness due to situational and connectionism, and acts as a limit to trust formation (Yoo, 2019, pp.194-195). The factors necessary to restore this trust relationship will be the resolution of the aforementioned responsibility gap, goal gap, management gap, capacity gap, information gap, and financial gap. To bridge the responsibility gap, it should be emphasized that the government, civil society, and experts are together in an equal relationship, not an unequal relationship of power. Interrelationships must be autonomous and equal (Yoo, 2019). In particular, the Ministry of Environment or the NWMC should lay down its authority and establish various communication channels to emphasize mutual exchanges and collaborative relations with various institutions and organizations. To bridge the target gap, a common vision and strategy for water management agreed by all parties should be established and embodied. And we need to promote the big direction of water management in Korea to the people.

To ensure a fair and inclusive decision-making process, all stakeholders should be allowed to participate without feeling excluded. To address any gaps in policy, the MoE and the NWMC

should take the lead. However, they should also actively seek opinions from civic and expert groups to come up with improvement measures through research and discussion. The government plays a crucial role in this process, as it is responsible for finding solutions and persuading other stakeholders to cooperate properly if discussions through governance do not lead to a consensus.

In the mid-to-long term, the participation of civil society should gradually increase. Good governance promotes the decentralization of policymaking, enforcement, and evaluation powers, and empowers civil society, private companies, and key stakeholders. A recent example of expanding citizens' participation in policymaking is the public debate on Shin-Kori No. 5. The first poll involved 20,000 people, and eventually, 471 civic participants were selected. The civic participation group then underwent a month-long program to learn more about the topic through data collection, e-learning classes, and discussions. Experts were actively involved in facilitating decision-making (Public Debate Committee for Shin Kori Units 5 and 6, 2018). Although there are criticisms of such attempts in terms of representation and efficiency, if these side effects are further addressed, it could become a suitable method for public debate in Korea in the mid-to-long term.

However, it may be more effective to involve numerous experts in highly technical areas such as nuclear power generation to reach an agreement, rather than relying solely on civic participation. In policy areas with less professional complexity, citizens can operate in a system that discusses issues and makes decisions.

In the policy-making process concerning the role of civil society and civic groups, agenda-setting will be our main focus. Citizen participation should be expanded from the agenda-setting stage, and only then can we move on to the next step. Let's first take a look at the different types of participation related to agenda-setting, which include agenda space,

systematic agenda, institutional agenda, and decision-making agenda. Just like we mentioned earlier, the acceptability and sustainability of policies depend on the level of participation that is consistent with the changed status of citizens. However, we cannot give full power to citizens when it comes to setting the agenda. It is vital to share this responsibility with stakeholders during the input agenda-setting stage. Of course, the parties in the table below should establish a system that allows them to take more initiative while still including other stakeholders' participation.

**Table 15.** *Analysis of the types of engagement associated with agenda setting*

<b>Participation Type</b>	<b>Content</b>	<b>Subject of participation</b>
<b>Agenda universe</b>	Any ideas that can be discussed in society	Civic group, <b>Expert group</b>
<b>Systemic agenda</b>	Any issue that is perceived to be related to matters within the jurisdiction of the Government	Civic group, <b>Expert group</b>
<b>Institutional agenda</b>	A problem that policymakers feel is seriously and actively obliged to pay attention to	Civic group, Expert group <b>Public institutions</b>
<b>Decision agenda</b>	Institutional agendas that are attracting attention for active decision-making	Civic group, Expert group Public institutions <b>Government branch</b>

Civic groups should actively collect citizens' opinions on water-related issues and social problems. They should collaborate with experts to select agendas that can be turned into policies. Then, they should discuss how to implement the chosen policies with both public and private institutions.

Currently, not many governments focus on agenda setting in their water governance. Policymakers often use publicity to promote their agendas and win the support of citizens.

However, in a pluralistic society, external-led initiatives are becoming more common. These are cases where groups outside the government force the government to adopt a policy agenda. Civil society or civic groups take the lead in identifying social issues and promoting them as social agendas that eventually become government agendas.

During the initial stage of setting the agenda, civil society and experts should play a central role. They should choose a national agenda from among the various options. When selecting the final discussion agenda, it is more efficient and easier to secure legitimacy by involving all parties, including the government and public institutions.

When considering policy tasks, several factors must be examined to ensure their suitability. These verification criteria include cost, benefits, administrative ease, legitimacy, political validity, effectiveness, and efficiency. Moreover, to prioritize which agendas should be adopted, it is essential to consider the issue's salience, importance, and degree of conflict. This can be challenging to deal with in civil society due to the extensive research and data analysis required.

[Figure 7] Determining agenda status (Adapted from Kraft & Furlong, 2010)

Level of conflict (reverse of resolvability)	Level of issue saliency (perceivability)	
	Low	High
Low	Pork-barrel projects, such as research grants, water projects, agricultural subsidies	(Best chance of getting on the decision agenda) Airline safety
High	(Worst chance of getting on the decision agenda) Population growth, energy, health care reform	Crime, gun control, abortion rights

**Table 16.** Four main evaluation criteria to evaluate policy alternatives

(Patton and Sawicki, 1993)

Four criteria to consider

Content

Technical feasibility

① Whether it is logically possible to achieve the intended

	goal/result/impact
	② Measure whether the proposed policy or program has the intended effect, i.e. effectiveness
<b>Economic and financial possibilities</b>	Analyzing whether it's economically affordable and efficient If the absolute method focuses on securing the value of money with certain government expenditures, the relative method considers opportunity costs to examine whether this expenditure is the most efficient compared to other expenditure methods.
<b>Political feasibility</b>	The purpose of political analysis is to passively consider what alternatives have less political opposition, and actively find ways to increase political feasibility.
<b>Administrative operability</b>	Analyzing whether the proposed policy or program is manageably capable of producing or delivering the intended output

It is crucial for governmental agencies and public institutions to thoroughly examine and take into account the aforementioned factors. Throughout this process, institutions may seek guidance and collaboration from experts or civil society. The NWMC serves as a governing body for both the private and public sectors, and is designed to hold sway in all policy-making processes. This presents a fresh chance to rectify past issues of state-led decision-making and stakeholder involvement, particularly given the composition of multiple stakeholders in the input stage of agenda-setting.

The government and public sector should be open to accepting the information, knowledge, and know-how that the private sector possesses. By maintaining an open attitude and promoting communication, we can prevent the harm caused by policy monopoly. It is crucial that we focus on establishing governance that leads to optimal measures and maximizes the benefits for all parties involved.

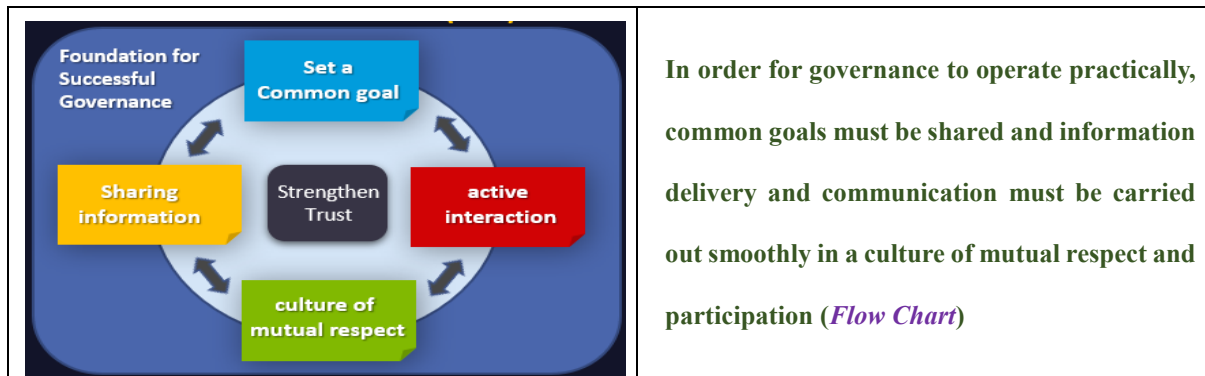
In retrospect, the government's efficient work and collaboration with companies in the four-river projects resulted in specific outcomes within a short timeframe. However, due to the lack



of communication and information sharing with civil society, numerous problems and conflicts arose, leading to continuous distrust even after the project's completion. The ongoing controversy has generated significant social costs, which could have been avoided if the government had consulted with civil society during the project planning phase. Nowadays, procedural democracy and legitimacy are essential for the smooth progression of administrative procedures. Citizens no longer wish to be mere beneficiaries of policies, but they want to be actively involved in policymaking and express their opinions. As a consequence, it is crucial to strengthen the mandatory collection and review of feedback from stakeholders such as local governments and civil society. The complexity of modern society demands more collective intelligence. Governance has become an essential process and result for policy success. The government needs to create an efficient governance system by ensuring that it operates well, talks to each other, and reaches a consensus. If governance fails to function smoothly and lacks agreement, the basis or location of responsibility may not be clear. However, the government is ultimately responsible for governance operations because it is the subject of exercising the authority delegated by the people. Additionally, governance should be operated smoothly to achieve its purpose, and the results should be reflected in policy formation. Civil society should also strengthen its expertise with knowledge-based information. The government should have a mutually inclusive attitude towards civil society. Good governance is a sustainable process in which governments and civil society build mutual trust through more inclusive and competitive sustainable relationships in the mid to long term and move toward complementary and transitional governance rather than being instrumental (Joo, 2008). Governance is a new administrative system that has just begun. It has the potential to efficiently solve social challenges if it is refined through numerous studies and experiments in the future. However, this requires accountability of all participants, strengthening of mutual partnerships for common purposes, and subdividing of roles when necessary. For instance, the U.S. military is

restructuring its system with the trend of utilizing specialized networks of civilians, military personnel, and contractors. The key challenge lies in reducing transaction costs and building a seamless network based on mutual trust.

**[Figure 8] Foundation of successful governance**



## ***2) Efficient construction of conflict resolution***

### ***(1) A new methodology for conflict resolution***

In recent years, the Alternative Dispute Resolution (ADR) method has emerged as a faster, cheaper, and more professional method than a lawsuit. ADR is a generic term for various methods and means of resolving disputes without judicial procedures such as trial, and is also called 'appropriate dispute resolution' or 'amicable dispute resolution' (Nolan-Haley, 2008). From the perspective of public conflict management, ADR includes various democratic procedures and methods other than trials to resolve various disputes and conflicts between private and public actors participating in the policy process. Specifically, ADR can be understood as a comprehensive concept that includes all of the participatory decision-making techniques such as third-party intervention such as negotiation, mediation and arbitration between stakeholders, and public debate. Accordingly, public debate procedures such as Shin

Kori Units 5 and 6 (2017) and college entrance reform (2018) need to be included in the ADR's category (Sim, 2022). The advantage of ADR is that it promotes the relationship between the conflicting parties by preparing creative alternatives. In the conflict resolution process, the predictability and self-determination of the conflict parties are increased, thereby increasing the satisfaction of all parties. ADR emphasizes joint win-win and voluntary acceptance of the parties. However, in Korea, ADR systems and organizations are not functioning properly due to a lack of expertise or resources. To revitalize alternative dispute resolution methods, ADR-related research must first be activated domestically. Next, it is necessary to improve ADR-related systems and organizations, such as securing budget and follow-up control, and to change social awareness (Im, 2012).

Currently, there are specialized organizations within the Ministry of Environment that use ADR, such as the Environmental Dispute Committee. However, the NWMC has been established with the main task of leading mediation and arbitration on water-related issues. To achieve this, the budget and organization necessary for conflict management within the NWMC should be expanded. Through this, it is necessary to establish a conflict resolution process and support the conflicting parties in establishing a point of contact for resolution. It is important to actively refer to overseas cases, and it would be beneficial to learn from the consultation and intervention system used in the UK and France by introducing the National Public Debate Committee to resolve water-related conflicts.

**Table 17.** *Major institutions for resolving conflicts in foreign countries(K-water, 2019)*

Country	Institution	Content
United States	Federal Coordination and Reconciliation Agency (FMCS)	Provide comprehensive conflict prevention and resolution services to the federal, public and private sectors in grievance coordination, relationship development training, ADR services

		and training for federal agencies, etc
	U.S. Environmental Dispute Resolution Agency (NCECR)	Focus on conflict resolution, including environmental, natural resources and shared land related to the federal government, and use of collaboration, negotiation, structured dialogue, arbitration, etc. by neutral third parties to prevent, manage and resolve environmental conflicts
<b>France</b>	Public Debate Committee (CNDP)	An institution responsible for securing civic participation in the event of a significant socioeconomic challenge or a significant impact on the environment or land use plan in the course of development or project at the government level
	Rights protection officer (DDD)	The ombudsman system is responsible for improving administrative services, and mediates disputes between citizens and public institutions
<b>Great Britain</b>	Regulators	An institution established under the Act of Parliament and operated independently from the government. Regulators have the authority to investigate, delegate, advise, authorize, trust, or enforce, etc
	Ombudsman	An independent grievance agency established by the British Parliament to investigate general grievances relating to public or private enterprises and to recommend improvement to administrative agencies

***(2) A specific methodology for conflict resolution***

First, Citizens have a strong tendency to subjectively recognize risks based on their own experiences rather than objectively and scientifically. Accordingly, the risk can be overestimated or underestimated (Slovic, 2000). Therefore, in order to prevent public conflict,

objective and accurate information must first be provided to citizens.

Second, Citizen participatory governance is an important key not only in the policy process but also in the conflict resolution process. Citizen participation in governance will also contribute to solving the problem of information asymmetry and the moral hazard of bureaucrats. Accordingly, civic participation should be activated to solve the problem of public conflict in the future. Specifically, as mentioned in the previous chapter, citizens present concerns about future social problems as an issue at the agenda-setting stage, and participate in consultative bodies and public hearings at the policy formation stage, so that citizens can actively assert their opinions. In the policy evaluation process, feedback on whether the government has well accepted and implemented citizens' decision-making can be given through civic opinion polls and evaluation committee activities.

Third, The government should expand its organizations and manpower to prepare a plan for the establishment and operation of desirable conflict management organizations and conflict management support organizations. This organization and manpower should actively play the role of analyzing conflict impact, identifying conflict tasks, and supporting conflict mediation. Conflict workers in the government and public institutions should be educated on conflict resolution through dialogue in a horizontal situation with citizens, and further strengthen their specific capabilities, such as learning conflict resolution methodologies.

Fourth, The government needs to establish a public discussion system by introducing a public discussion organization such as France's National Public Debate Committee (National Assembly Budget Office, 2014). The public discussion system is also a means of enhancing citizens' policy acceptance. In addition, with the help of experts, ordinary citizens with information and knowledge can actively discuss with other citizens and bureaucrats, thereby establishing deliberative democracy and enhancing mutual trust and understanding. There are

two important points in public discussion. First, political equality must be achieved in which the opinions of all participants are fully accepted and embraced. Second, on a matter, all participants must form refined and agreed opinions through serious deliberation, learning, and desirable discussions. Through this process, collective intelligence can be formed and positive collective rationality can be built between opposing groups.

Finally, I would like to add necessary matters to the National Water Management Commission, which has emerged as a national organization dedicated to water management conflicts. As a central organization for conflict resolution, the National Water Management Commission should actively intervene in potential conflicts as well as those that have already occurred. For example, even before the conflict is materialized, it is necessary to review countermeasures in advance and mediate among mutual stakeholders regarding water conflicts that are sufficiently predicted. In addition, it is necessary to intervene in the conflicts between the upstream and downstream areas caused by water to ensure that the property rights of residents in the upstream areas are guaranteed by investing in tourism resources or deregulation targeting the upstream areas through recommendations to the government. In the future, it is necessary to lead the research and collect opinions on regional development plans in the upstream areas. It is also necessary for the committee to lead the cooperation between various related departments. However, in order to fulfill its responsibility as a practical conflict-solving organization, it should be given corresponding authority. Under the current law, the committee may mediate the conflict, but this is not compulsory like judicial reconciliation. It would be in line with the status of the committee to change the effect of the committee's decision to a compulsory effect such as judicial reconciliation rather than mediation (Jung, 2019). In addition, it is necessary to supplement detailed procedures such as forcing various stakeholders to participate so that the committee can make rational decisions, and to strengthen sufficient budget and administrative support to enable case studies such as professional analysis.

#### ***D. Personnel improvements***

In 2022, the southern part of the country suffered from a severe drought while the metropolitan area was damaged by heavy rains. Due to climate change, water management needs to focus on responding to both droughts and floods while reducing carbon emissions. To achieve this, structural measures for coping with natural disasters should be strengthened, and facilities for carbon reduction should be improved. However, there is a lack of manpower and budget, especially in local governments, to manage water supply and disaster response. To overcome this, local governments need to conduct a thorough diagnosis of their current situation by analyzing their assets, service levels, management processes, and budgets. This should be led by the central government in cooperation with local governments to create an analysis framework and promote nationwide analysis. Additionally, the central government should develop an integrated system to manage water supply and disaster response nationwide.

The central government should actively support local governments in creating a specialized system related to water, to foster water-related personnel. The government should lead the development and education of manpower, the advancement of facilities, the support of insufficient financial resources, and the spread of related content after R&D. Firstly, efforts are needed to resolve the shortage of manpower and improve the expertise of local government water supply officials. Currently, due to circular positions, the average tenure for local government officials is only two years. In the past, local governments selected and hired public officials in charge of water supply who exclusively took charge of water supply work until retirement, thereby securing expertise. However, the related professions have now been abolished. The water department, in particular, has become an unpopular department due to difficulties in promotion, making it difficult to attract talented people (Kim, 2006).

Water management experts should be hired to develop systematic water management for

local governments. The MoE should revitalize the academy that trains water management experts. In 2022, the MoE, along with water-related organizations such as K-water, offered 47 water-related training courses free of charge. The courses were aimed at training 1,700 water industry professionals, including officials in charge of water industry policies and practices in public institutions. The training courses can be conducted both online and offline to create better educational effects (Oh, 2022). Additionally, an education platform should be established to provide easy access to various lectures and papers by water experts. Through this platform, various institutions can exchange opinions, and promote water technology developed by each institution and share research results, thus creating synergy for the entire water industry.

A specialized curriculum must be created for local government officials that reflect unique characteristics that differentiate them from general water companies. This will require continuous communication with the central government, which can be led by the MoE or well-equipped educational institutions such as K-water. Education is crucial for improving the quality and quantity of manpower in the industry. The water industry is an essential industrial area that will determine the future of Korea. New areas such as water regeneration, reuse, and ultrapure water are being developed. However, the industry continues to suffer from a shortage of manpower. Therefore, the supply and demand of manpower in the water industry should be given more attention in the future of domestic water management.

### ***E. Budgeting improvements***

The budget is a crucial issue when it comes to water management. It has been a longstanding problem in the industry, and as the focus of budgeting shifts towards welfare, economy, and job-related matters, the budget for the water sector is gradually declining. This is especially evident in small local governments where financial and management efficiency is deteriorating due to population decline and regional extinction. As a result, the recovery rate as a charge to



production cost is gradually decreasing. This, along with people's lack of interest in water, results in a delay in investment in facilities. Additionally, elected officials tend to concentrate on budgeting for popular projects such as civil engineering and cultural projects that are highly responsive to citizens, while invisible infrastructure such as waterworks is often overlooked.

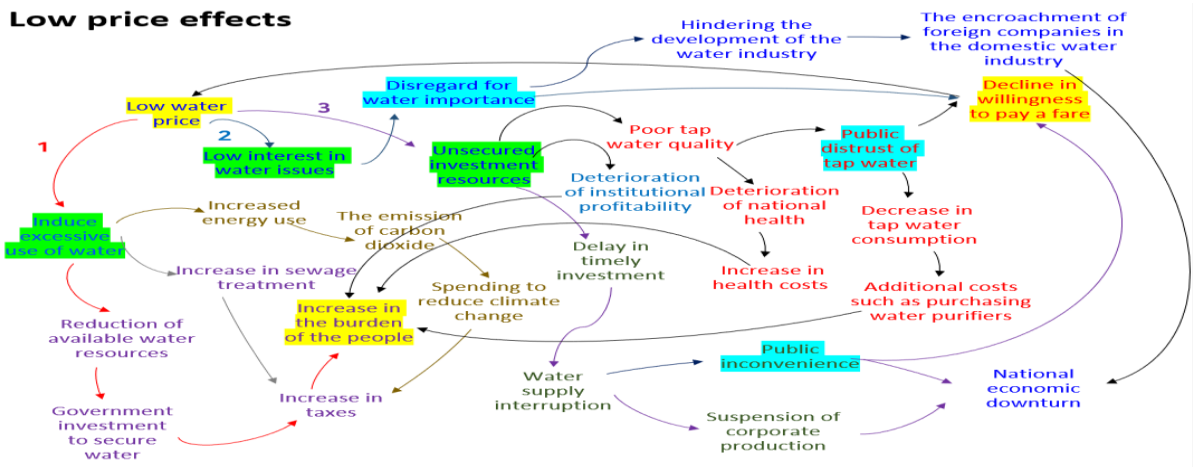
In areas with limited financial resources, improving outdated water supply facilities and implementing measures to combat climate change is impossible without national budget support. Ironically, most flood damage occurs in small, locally managed rivers rather than larger state-controlled ones. Studies have shown that smaller rivers receive less maintenance. A 2019 report submitted to the National Assembly by the MoLIT revealed that only 48.07% of local rivers and 81.41% of national rivers were maintained properly by their respective authorities. Unfortunately, local governments often lack adequate funding to maintain these rivers, leaving their communities vulnerable to disaster. Ultimately, it is the local people who bear the brunt of these natural calamities.

"How can we secure a sufficient budget to promote efficient water management? First of all, we should raise the charges in line with the cost of production. Continuous deficits lead to a lack of investment resources and a deterioration of service levels. Recently, people have been discussing the integration of local water supply to realize economies of scale and efficiently operate organizations, manpower, and facilities. Although the cost of water bills will initially rise due to massive facility improvements, management efficiency can be promoted in the long run. For the integration of local water supply to work, certain requirements such as the maintenance of water facilities and the ratio of water charges to production cost should be met before the integration. The government should provide support and specific standards for these areas." (Son & Kwon, 2019).

The issue at hand is the increase in fares for public utilities. The government has been

controlling these charges to ensure that low-income families can afford them and to prevent adverse effects on the industrial ecosystem. However, the low utility bills have led to excessive water usage, which is not sustainable. Until now, water prices have not been determined by the market, despite the rising water management costs due to inflation and climate change (Yoon, 2013). This has resulted in a decline in profits, making it difficult to invest in disaster response and provide clean and safe water. Artificial rate control has also led to a lack of interest and investment in water facilities, causing distrust in tap water among the public. However, simply controlling rates is not the solution, as it does not provide sufficient state funding. The system must evolve to address these challenges. As climate change intensifies, rate control is no longer a viable solution, as it contributes to carbon emissions.

[Figure 9] Adverse effects of low water prices (Personal analysis)



The excessive consumption of water has led to a reversal of the carbon reduction trend. As the demand for tap water increases, more electricity is needed to produce and transport it, which in turn generates more carbon. Unfortunately, there are not enough funds available to invest in reducing carbon emissions. As a result, we tend to overlook the intensification of climate change caused by the increased carbon emissions. This creates a vicious cycle where low public utility rates fail to address climate change. Furthermore, the costs associated with water do not include any external costs related to carbon emissions. The cost of producing water includes

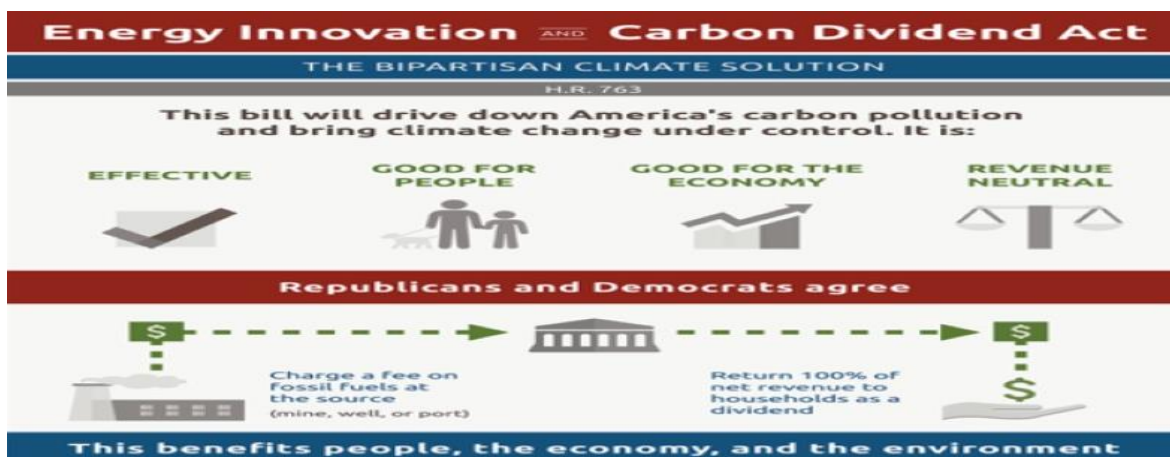
only the direct production cost, but this approach is causing negative economic externalities. To address this issue, an increase in water prices can be implemented, similar to the concept of carbon tax, which is a market-based policy aimed at managing climate change. As water prices increase, people will become more interested in conserving water and reduce excessive consumption on their own. This will also help in reducing carbon emissions, thus contributing to environmental improvement. Nowadays, carbon tax is being viewed as an essential policy tool to limit carbon emissions. It is a tax imposed on fossil fuels such as oil and coal that emit greenhouse gases responsible for global warming, based on the amount of carbon they contain. The carbon tax is a regulatory policy that corrects the negative external effects of environmental pollution (also called external economic effects) using price signals by attaching prices to non-market carbon emissions. Unlike direct prohibition regulations, it is a market-friendly regulation that induces changes in the behavior of market participants by artificially charging prices by attracting social costs caused by environmental pollution to market organizations (Cho, 2022, p.3). The biggest problem with the carbon tax is its fairness and social acceptance. When it comes to social acceptability, the carbon tax is highly resistant. France, for example, announced an oil tax hike in September 2018. This led to the Yellow Vest movement. It was sparked by the question that the increase in oil taxes, coupled with the existing government's wealth tax and lower capital income tax for the high-income bracket, could add to the burden on low-income brackets and lead to inequality in income distribution. The carbon tax introduced in Australia to combat climate change requires the nation's top 500 large carbon emitters to pay a certain amount of tax per ton. However, large companies, which have been burdened by the new carbon tax, passed the tax increase on to consumers, and Australia eventually pushed for it to be abolished (Son & Shin, 2020).

It is important to find ways to alleviate the social resistance and burden on low-income individuals caused by the carbon tax. One way to avoid social resistance is to alleviate the

regression of income. The regression of tax refers to the fact that direct taxes, such as income tax, are structured to increase in proportion to income. However, carbon tax is an indirect tax that is levied on goods. The manufacturer pays the tax directly to the government, but the cost is passed on to the consumer. This means that everyone pays the same tax, regardless of their income. As a result, the poor end up paying a relatively larger share of the tax burden compared to the rich, as the amount of tax paid is not based on income. Therefore, it is crucial to find ways to address this issue to make the carbon tax more effective and acceptable to everyone. A recent discussion has been on the implementation of a carbon tax and a carbon dividend. In the United States, 3,640 economics professors, including 27 Nobel laureates, have called for the introduction of a carbon tax along with a carbon dividend. They have argued that attaining carbon neutrality is not possible without such a tax. They also emphasize that all revenues collected through the carbon tax should be returned directly to all U.S. citizens in equal amounts to increase its fairness and political viability. Economists assert that most U.S. households, including the most vulnerable, can benefit financially if they receive more carbon dividends than increases in energy prices (Gang, 2021). To this effect, Congress introduced the Energy Innovation and Carbon Dividend Act of 2019, which has broad support from the Congress. (See Figure 10) The idea of a carbon dividend is based on the fact that fossil fuels and carbon products are more commonly used by the wealthy. A recent study found that in the past 25 years, the top 1% of the world's richest people have emitted more than twice as much carbon as the bottom 50% (Donga-science, 2020). As a result, carbon emissions are concentrated among high-income individuals. A carbon tax is levied on all citizens based on the amount of carbon they use, and the funds collected are then distributed equally among all citizens. The wealthy will pay a higher amount of carbon taxes but receive a smaller dividend. On the other hand, ordinary people will pay a lesser amount of carbon taxes but receive a higher dividend. This system will help to address the shortcomings of regressive indirect taxes and

gradually make them more equitable, easing the burden on ordinary people. In Switzerland, carbon tax revenue in 2019 was about 1.5 trillion won. Two-thirds of this revenue was refunded to Swiss residents as carbon dividends, regardless of their carbon usage. The remaining one-third was used for energy efficiency projects for buildings and homes, as well as for renewable energy projects (Cho, 2022). Recently, Korea has started indicating climate and environment charges separately on electricity bills. To reduce the impact of environmental pollution, such as greenhouse gas emissions, electricity consumers in Korea are charged a climate and environmental fee of 7.3 won per kWh.

**[Figure 10] Carbon dividend laws in the United States**  
 (carbon pricing leadership coalition, 2019)



In this way, it would be a good idea to apply the concept of a carbon tax and a carbon dividend to utility bills such as water and electricity as a pilot project. First of all, there is a great need for carbon reduction in this area. The two objectives of water scarcity and the reduction of carbon generation in the water sector can be achieved by introducing the concept of a carbon tax and a carbon dividend into water management. In addition, by installing facilities to cope with drought or flood, or installing new and renewable energy facilities in water purification plants, related resources can be used to respond to climate change, thereby faithfully implementing climate change and carbon reduction purposes. Of course, some

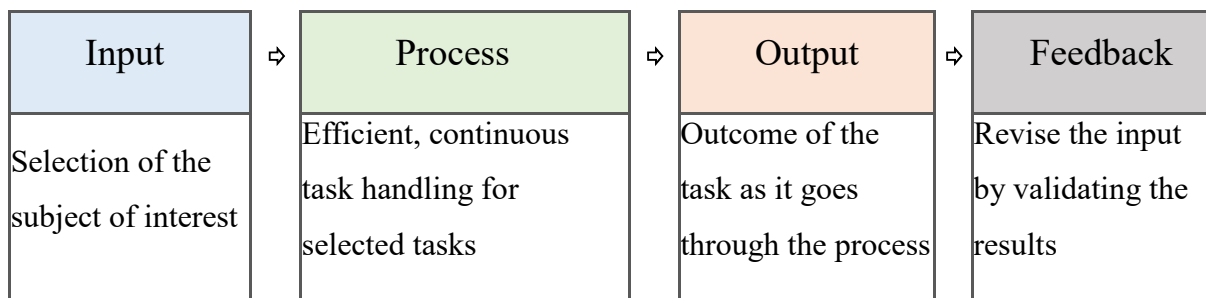
resources can be used to pay carbon dividends. As a way to alleviate other resistance, it is possible for low-income families to exempt a certain portion of water charges or to support low-income families using the increased tax revenue (Kim, 2014). This principle should be applied equally to rate hikes. For instance, when water rates increase, additional measures should be considered to help those who may be struggling financially. It is also a good idea to provide financial support to local governments so that they can assist vulnerable individuals with the financial resources raised from the water rate increase. With these resources, various methods can be explored, such as improving water facilities in vulnerable housing or increasing the efficiency of existing facilities.

#### IV. Conclusion

##### *A. Roadmap of water management system improvements*

In this capstone, my main goal is to discuss the design of an ideal water management system. I believe that a well-equipped system can solve any problem efficiently. On the other hand, without a system, even the strongest will not achieve successful water management. The system comprises inputs, processes, and outputs that are derived from the inputs. Finally, the output is verified, feedback is derived, and it is reflected in the input to complete the process.

**Table 18.** *System procedure charts*



To design a system effectively, it's crucial to analyze the various aspects of the current system.

To achieve this, the SWOT framework was utilized to identify the positive and negative factors of the current system. By using the SWOT framework, we were able to identify areas that require improvement to move from the current system to a better one.

When it comes to the system, the input plays the most significant role. Considering the lack of time and resources, the key issue is to determine which part of the water problem we are interested in and to put our energy into that.

Water governance is about how to achieve desirable outcomes throughout the policy process. To do this, we need to encourage civic participation in the process. Citizens now want to take a leading position in the process, rather than being managed from a subordinate position. In the past, if an agenda related to water management was determined by a few policymakers in the input process, and the government focused solely on that agenda and made continuous investments, they would inevitably face civil complaints. In the input process, it's crucial to properly reflect the issues that citizens want to improve upon.

The implementation of water-related tasks in any process is often met with resistance, especially when it comes to matters of great social value. This can make it difficult to proceed, even if a good policy that citizens want is derived through governance. To overcome these challenges, a systematic conflict management strategy must be put in place to resolve conflicts and increase social acceptance, thereby promoting policies smoothly.

The efficiency of water management in Korea is still an issue, and it is necessary to consider how to improve it. Firstly, there needs to be a clear control tower for the overall water-related work to ensure tasks are subdivided and responsibilities and authorities are assigned to relevant public institutions to force them to proceed efficiently. Secondly, the operation of water-related facilities needs to be more efficient to respond to climate change and increasing water demand, which may involve expanding existing facilities or building new ones.

The third aspect of the process concerns continuity. Firstly, it is crucial to consistently allocate resources and manpower to address the mounting water-related issues. It is imperative to tackle the current shortage of human resources and secure the necessary resources. Secondly, we have attempted to discuss system improvements in detail. However, since the topic is vast, we have focused only on planning-related matters. Effective planning is a prerequisite for aiding citizens, but the current situation does not allow for it. We will continue to examine foreign cases and identify the inefficient aspects of the planning process.

If the appropriate inputs and a smooth process are implemented, it will lead to positive results. These results are referred to as outputs. Finally, it is essential to analyze and verify the outputs and derive meaningful insights. Incorporating these insights into the input will allow for optimal outcomes.

### ***B. Limitations and future research***

Starting with this capstone for the first time, I wanted to take into account all the problems in water management as a troubleshooter to derive logical and creative systems and solutions. The most difficult thing about water governance is the question of which citizens should participate and how. Participating citizens cannot be viewed as representing the opinions of all citizens. This leads to the problem of political equality. I will continue to consider specific measures and forms for citizens' participation in governance that can compensate for these limitations. There is a counterargument as to whether it is worth the residents' participation, although as a representative of citizens, already elected members of the National Assembly or city council members can participate to reflect the public will. Nevertheless, there is already a lot of consensus on the necessity of civic participation-type policy-making. It is necessary to enhance transparency in the government's decision-making process, ensure diversity, and strengthen democracy. However, in the process, it is necessary to consider how to reflect civic



opinions and what variables and improvements should be made in consideration of Korea's unique characteristics.

It was emphasized earlier that objective sharing of information is necessary as a requirement for the success of conflict resolution and governance. This means that objective and accurate data related to all war situations, such as the war situation room, are shared with everyone in the place. It is necessary to prepare a plan how to create the same environment as the war room in governance or conflict process so that citizens can share objective information and have the knowledge necessary for decision-making from basic knowledge to in-depth discussions or solutions.

In the conflict resolution process, the ADR method will gradually replace the part that the lawsuit was in charge of, but the ADR has a wide variety of types and methods. In addition, more consideration and empirical research will be needed to determine which ADR method is best for solving the problem in more complex and diverse situations.

Regarding efficiency improvement, the issue of communication that formed a consultative body between public institutions was emphasized, which is still happening between institutions. However, thorough research is needed in advance on how and how problems such as institutional integration for smooth policy implementation should be integrated.

The climate crisis was also briefly mentioned in the efficiency section. What I mentioned was that in order to cope with the climate crisis, it is necessary to secure a budget for response along with water conservation, and in relation to the purpose of the carbon tax, we should increase a certain portion of our water bill. And at that cost, we wanted to install solar facilities in water purification plants or pressurization plants or make additional budget investments for eco-friendliness. However, this alone has limitations in overcoming the threat of the upcoming climate crisis. Specifically, more consideration will be needed in the water management field on concrete ways to overcome the climate crisis.

In this capstone, not all the problems of water management in Korea were discussed. Debate on various water-related rights, reorganization of water-related laws and regulations, and distinction of responsibilities and roles in water management between central and local governments are tasks to be discussed in the future.

Personally, in this capstone, I think it is meaningful to look into the current status and issues of water management in our society and think about our own system. We will continue to research this system more elaborately, subdivide the components of the system, and think more deeply about various variables so that our water management can take a step forward.

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