Integrated water management strategies centered on local governments according to the unification of water management

By

RYU, Sehwan

CAPSTONE PROJECT

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

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ABSTRACT

Integrated water management strategies centered on local governments according to the unification of water management

By

Ryu, Se-hwan

This report presents ways to achieve water management and solve water problems within basin through organic water management integration between local and local governments.

In the short term, the 'K-water Water Management Integrated Implementation Promotion Team' is formed to produce short-term results of policies and prepare for integrated materials management. In the long term, 'The water management integration implementation council' involving committees, local governments, institutions and research institutes that can serve as an implementation platform for integrated water management by the National Water Management Committee will be formed to supplement water management policies and coordinate roles with local governments.

This will enable the unification of water management policies, from small-scale water management controlled by local governments to large-scale basin management managed by the state, to be successfully implemented.

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1. Introduction

1.1 Background

The water management system in the past was divided into different ministries, raising various issues such as lack of integrated water management policies, overlapping work between ministries, and over-investment and inefficiency. Therefore, many experts here have argued for the need to unify quantity and water quality management in water management policies.

The global trend is to unify the ministry into an environment management department that integrates the basin, water quality, and aquatic ecosystem rather than the distributed water management centered on supply. The trend shows that 23 OECD countries are also implementing water management integration policies in environment-related ministries. In addition, at a time when a shift to a new paradigm for water management in the era of the 4th Industrial Revolution is required, the Environment Management Department, with the focus of water quality and aquatic ecosystems, needs to be in charge of water management unifying and basin integration management. This has been established through a number of previous studies, including theoretical grounds and principles, and step-by-step policy road maps (Kim, 2017).

To meet this need for unified water management, the government decided to integrate water-related tasks, such as dualized water quantity, quality, and disaster management, with the Ministry of Environment starting in 2017.

Thus, the Act on the Organization of Government, the Framework Act on Water Management and the Act on the Development of Water Management Technologies and Promotion of the Water Industry were enacted and amended. Through this, most functions, such as quantity, water quality, and disaster prevention, were unified into the Ministry of Environment.

The Water Management Unifying Policy has achieved a total of 10 positive outcomes based on four major initiatives: 1. laying the foundation for an integrated water management

system; 2. establishing a rapid response system to secure water safety; 3. supplying clean drinking water; 4. Creating the value of water; and follow-up policies are being pursued continuously (Ministry of Environment, 2019).

The main contents and achievements of unification of water management are as follows. First, it laid the foundation for an integrated water management system. It plans to establish core values for water management such as publicity, sustainability, and stability, and establish goals such as integrated water management based on basin and establishment of governance, and reflect them in the basic plan for national water management. In addition, as shown in the following table, the Country Water Management Committee and the Basin Water Management Committee were formed to form an integrated water management execution consultation platform that can quickly promote water management planning, water dispute adjustment, and policy roles. Efforts were made to solve regional water problems.

Table1: Organization of the Country/Basin Water Management Committee

	Country Water Management Committee	Basin Water Management Committee
Affiliation	president	Country Water Management Committee
Chairman	2 co-chairpersons (Prime Minister and one civilian)	Two co-chairmen (Minister of Environment and one civilian)
Main function	deliberation and resolution of Country/basin plans Mediation of water disputes between basin, etc.	deliberation and resolution of basin plans Mediation of water disputes in basin, etc.

Second, a rapid response system was established to secure water safety. The government strengthened cooperation between agencies for integrated management of water quality and water quality for water quality improvement, green tide response using environment improvement water, drought overruns through the establishment of a stable water supply system, and flood response. Third, efforts were made to advance the management of pollutants and strengthen the reliability of tap water in order to supply clean drinking water.

Fourth, efforts were made to create an eco-friendly water circulation city and to revitalize

the water industry and create jobs in order to create prices and innovate water management.

Based on these four Agendas, the government plans to implement a unified water management policy.

1.2 Problem and limitations

Despite the positive effects of this policy, some say that it is inappropriate for a single ministry to do development and preservation work that is difficult to coexist, lack understanding of water management, and need to integrate water management more than the integration of government water management organizations (Kim Seung, 2017).

In addition, there are limitations in the implementation of integrated water management because the water management functions of each local government, water-related organizations, and departments for river management, agricultural water, and power generation are divided and roles are ambiguous.

In order for the water management unification policy to succeed, it must be linked/managed in the entire water circulation process from the management of local government tributary streams to the river management, intake, water purification, drainage (water supply) and sewage, and this must be linked to large rivers. However, water management administrative organizations currently operated by local governments have different types of systems for each province, city, and county. As a result, there are limitations such as inefficiency, lack of expertise and lack of policy connectivity with the central government. For example, local governments organize their own authority, finances and manpower for each local government based on the "Local Autonomy Act," and the method of operation is entrusted to their own or water-related specialized institutions. However, due to the relatively small population and low policy order, there is a lack of dedicated personnel and budget needed for water-related projects and management.

1.3 Research Objective

In order for the water management unification policy to be effective, it is necessary to realize the unification of water management policy that people feel immediately and to derive results. To do this, the central government's integration and reorganization, as well as the establishment of the role of local governments and water-related organizations that are actually water management subjects are key. Therefore, This report aims to derive effective measures to realize and implement effective policies through an in-depth review of the current unification of water management policy.

In this paper, we analyze the problems of the water management unification policy and review the direction in which the policy can have a positive impact on small local governments. In addition, it presents a 'local-centered water integrated management strategy' that K-water can lead and proposes a strategy to commercialize it.

2. An Analysis of the Influence of the Unification of Water Management Policy

2.1 An analysis of the Water Management Unification Policy

Although there are various studies that form the basis of water management unification, similar studies have been conducted such as analysis of inefficiency caused by water management decentralization, analysis of best practices, establishment of basic principles for water management unification, and eliciting policy alternatives, so the Kim(2017) research report has been adopted among various research reports.

The inefficiency of water management decentralization was analyzed.: Expected effects of unification were presented by classifying them as wide/local water supply, ecological canal project, water information (metering network), non-spotted pollution reduction and low impact development (LID), and overseas cooperation projects.

In the case of wide and local water supply, it demonstrated the inefficiency that excessive

consumption of water and facility investments exceeding the demand forecast resulted in redundant investments due to adequate water supply and supply adjustment. Thus, the effects of maintenance, utilization, and integrated operation were presented through unified water management.

In the case of water information (metering network), the financial expected effects of adjusting the measuring network were analyzed through the analysis of the measuring points of the flow rate (water level) in Korea.

In addition, it analyzed the meaning of the construction of consistency and efficiency of water management policies through unified water management, focusing on the case of Israel. In the case of Israel, it has been shown that it implemented a water management unification policy and achieved water management efficiency since the establishment of an integrated management organization (IWA) in 2007.

In order to establish a legal basis for sustainable integrated water management, all types of laws related to water management policies of related ministries (approximately 78) were identified and measures for integration and coordination were proposed. In other words, the Acts and systems related to water management were investigated and analyzed and proposed step-by-step adjustment measures to redefine the basic direction and status of the integration of distributed water-related legal systems by the ministries. In addition, the report reviewed the adjustment and cooperation of water management functions with other ministries and presented a three-step policy roadmap (proposal) for implementing water management unification and further preparing for integrated water management.

But, the research analyzes the current situation in Korea and validates the effectiveness of overseas cases (Israel, OECD) for example. In other words, although there is sufficient understanding of the overall water management system in the country, it did not consider the environment and socio-political conditions of our country in depth.

Although the above study considered a unified water management policy considering the environment centered on the large basin (Han River, Nak-dong River, etc.) there was no in-depth review of tributaries that had a significant impact on the large stream, one of the biggest characteristics. For example, local governments make up their own authority, finances, and personnel based on the 'local autonomy law' and manage water supply sources, tributary streams, water supply and sewage facilities. For complete water management to be unified, discussion of water management measures by small local governments, which have a great impact on large basin areas, is needed.

2.2 An Analysis of the Impact of the Current Water Management Unification Policy.

Policy analysis should consider current problem situations and provide solutions as soon as possible. To do so, we need to review the purpose and problems of the current policy.

The following table shows the effects of the unification of water management policy on the government, the Country/basin water management committee, and the central government, including citizens and related organizations.

Table2: Impact Analysis on 'Unification of Water Management' policy

	Positive, Expected effects	Negative, Limitation
Local Gov, Citizen, NGO	- It is possible to solve chronic water problems (lack of quantity, deterioration of water quality, etc.)	- Low impact of policy: low fiscal independence, small water management, etc. - Policy benefits are low when promoting basin water management - There is a constant possibility that autonomy for water management(budget, manpower, etc.) will be reduced.

Country/basin Water Management Committee	- Redistribution of biased resources (quantities): Solving the problem of water supply and adjustment preventing overlapping investments - It is possible to solve the national water problem and reorganize the basin-centered water management. - Promoting new projects such as ecological streams	- Difficult to collaborate with stakeholders (local governments, NGOs, institutions) - Lack of experts/institutions' ability to implementations - In the early days of the policy, there is confusion due to the unclear scope of work among government organizations.
Ministry of Gov.	- Water management is diversified into government ministries and agencies, which can cause selfishness, but water management policies integrated with the Ministry of Environment can ensure consistency.	- Unable to clearly distinguish the scope of projects between government ministries, and other ministries other than the Ministry of Environment is concerned about a possible backlash.

Water policy is also one of the policies with many complex and conflicting elements, including economic interests, political capacity and political consensus. Therefore, various stakeholder analyses are required. The results of the stakeholder analysis are as follows.

Table3: Stakeholder Analysis on 'Unification of Water Management' policy

	Interest	Mean/Tool/Resource	Expected Outcome
Local Gov, Citizen, NGO	- Securing water quality and quantity - Regional economic development	- Local law(water-related) - Permission authority - Council, etc	- Requesting solutions to local water problems - Securing the Central government Budget
The institution(Water related)	- Business Area expansion - Revenue from the state or local government	- The central Government - Budget, manpower retention - Better relations with local governments	- Business authority demand
Country/Basin Water Management	- Outcome of Policy - Solving the national water	- Law (water relative), - Sub-institution(water	- Granting authority of the committee through revision

Committee Ministry of Gov.	problem - Establishing long-term water policies - The implementation of legally defined policies. - Sustainable development	relative) - Powerful authority, budgeting	of laws and regulations - Coordinating roles between countries, committees, local governments, and agencies

In the water management unification system, there are largely the Country/Basin Water Management Committee and the stakeholder of water-related specialized institutions, local governments, and central governments.

Interests conflict among local governments, water-related agencies and central governments. According to Park (2018), Korea's water management-related laws are largely divided into 13 laws, including the Waterworks Act, the Sewerage Act, the Water Recycling Promotion and Support Act, the River Act, the Underground Water Act, and the Dam Construction and Support for Neighboring Areas. Each law includes provisions for the Environment Minister and the Land, Infrastructure and Transport Minister to ensure that the purpose of the enactment of the relevant law can be met through means such as the establishment of a national plan and the enactment, designation, use, notification, and approval of a decree as described by the law. These laws are diversified from central government units to the Ministry of Environment, the Ministry of Land, Infrastructure and Transport, and the Ministry of Agriculture, Food and Rural Affairs to form governance.

Water should be managed in an integrated as a basin-based organism, but so far, many problems have been exposed in terms of efficiency and fairness, including the occurrence of overlapping and over-investment by function and facility, the increase of flood damage in tributary streams, and the imposition of water utility charges based on multipurpose dams and metropolitan water supply (Sim, 2014). In addition, Line Ministry, which enforces related laws,

is different, and projects for similar purposes are being invested in duplicate, wasting budget inefficiently. And the current water management system was difficult to efficiently manage water due to discrepancies in the water management unit of the basin unit centered on the administrative unit. In addition, due to the lack of connectivity with local governments due to the establishment and operation of water management plans centered on the central government and its affiliated agencies, it was difficult to adjust interests, and the opinions of stakeholders such as residents/social organizations were reflected.

In the end, water-related unification should be successful, seeking ways to serve as a bridge between the government and local governments.

2.3 Complementary directions for Unification of Water Management policies

This should be led by the Country/Basin Water Management Committee, which was launched as a unified water management policy, and the Commission should clarify the policy to solve water quality/quantity problems in the region, solve water problems between regions, establish long-term water policies, and revitalize water-related industries.

Therefore, the Water Management Committee should realize the Negotiation Strategy of the Stakeholder. Each SWOT analysis to improve the water management unification policy is shown in the following table. SWOT analysis was conducted to improve water management unification policy as follows.

The main objective is to assess the merits and demerits of the current policy experienced by the government-led committee and to determine the opportunities and threats to consider in designing new policy options.

Table4: SWOT Analysis

“Strengths”	**"Weaknesses”**
- The committee has a well-experienced Institute (Water Related). The Institute has specialized manpower/structure/budget. - The budget can be secured according to the central government's will to implement policies. - Policies can be realized based on the Water Management Act.	- Local governments have various licensing rights under the authority of local laws, councils, etc., which can hamper the implementation of policies. - Lack of authority over basin water management, low policy implementation, and poor finance due to a dualized organization of local governments - Insufficient capabilities of experts/organizations for policy implementation - The flood damage of tributary streams is increasing.
"Opportunities“	**"Threats“**
- Increase water management efficiency through redistribution of concentrated water and efficient use of resources - Mid- to long-term planning of water management facilities prevents overlapping investment and enables integrated operation - High water problems (quantity/quality) in the basin can be solved. - Distributed water-related functions and facilities can be integrated. - Business areas can be expanded.: Eco-friendly water circulation city, ecological river project, water industry revitalization, etc.	- Local Gov, Institute's Effect to Expand it's Water Management Authority - Local governments operate water management facilities individually, which can cause continuous water problems. - Many stakeholders are depending on decentralized central, local government organizations, and institutions.

But SWOT analysis can’t give the solution for improving way, so we want to do TOWS analysis.

Table5: TOWS Analysis

SO (Maxi-Maxi strategy)	**WO (Mini-Maxi strategy)**
√ Promote a policy of unifying water management by utilizing a highly experienced organization with business capabilities and experience.: The company has a well-experienced Institute (Water Related). The Institute has specialized manpower/structure/budget. √ Establish mid- to long-term integrated plans for distributed water management facilities √ Revised the law to increase the effectiveness of the Water Management 3 Act: Revised the Act to promote eco-friendly water circulation cities, ecological river projects, and water industry revitalization. √ Implementing pilot projects for short-term performance: Prove that chronic water problems (quantity/water quality) in the basin can be solved to verify the effectiveness of increasing water management efficiency.	√ Complementation of water management committees including municipal and provincial governments: Solving pending issues in the region by integrating water management facilities within and between regions and establishing a management plan √ Implementing pilot projects for short-term performance: Prove that chronic water problems (quantity/water quality) in the basin can be solved to verify the effectiveness of increasing water management efficiency. Searching for the direction of development of local governments by promoting new projects √ Revision of local laws in connection with the Water Management Act √ Reorganization of local governments according to the unification of water management: Improving effectiveness by securing manpower and budget
ST (Maxi-Mini strategy)	**WT (Mini-Mini strategy)**
√ Promote a policy of unifying water management by utilizing a highly experienced organization with business capabilities and experience. √ Using government and affiliated organizations to form consensus by region √Implementing policies through securing the central government's budget	√ Revision of local laws in connection with the Water Management Act √ Reorganization of local governments according to the unification of water management: Improving effectiveness by securing manpower and budget √ Revised the law to increase the effectiveness of the Water Management 3 Act √ Organization of the committee, including local governments, NGOs, etc.: To find solutions to water-related issues

2.4 Policy objective and Issues

Realize water integration management and solve water problems through the integration of water management between local and local governments in the basin.

Collaboration among government organizations is essential to achieve the goal of unifying water management. However, restrictions between different organizations, regions, and stakeholders often result in unexpected consequences. Without an organic combination of water-related organizations to realize effective water-related policies, this can serve as the biggest obstacle to policy.

Wanna(2008) presents the following vulnerabilities that collaboration could lead to. "First, it could weaken political accountability. A weakness that can be experienced in collaborative activities is that it is difficult to ensure political or managerial status. Second, the responsibility of the work may be weakened. Collaboration can blur the boundaries of responsibilities more than the current state. Third, collaboration can frustrate decisions rather than expedite them. Collaborative participants can make different decisions when their interests go against them. Fourth, collaborative activities may operate for the opposite purpose if participants' goals and incentives are consistent or incompatible. Fifth, the government was criticized for not participating in collaboration in a sincere manner. Collaboration can begin for hidden political reasons, and it can only be a bluff or a smokescreen measure. These formal cases of collaboration can worsen trust in government and policy processes."

Therefore, establishing a sustainable integrated management system requires establishing governance among water-related organizations. Therefore, after the unification of water management at the central government level, which integrates water management divided into the Ministry of Environment (water quality) and the Ministry of Land, Infrastructure, and Transport (quantity), it should be reorganized into a comprehensive and future-oriented integrated water management organization at the local government level. As

the OECD Regional Development Policy Committee in 2015 also emphasized the harmonization between the three sectors of policy, place, and people for successful water management governance, the establishment of a regional-level water management system should comprehensively consider 'consistency and linkage of water policy', 'cooperation between stakeholders' and 'water management centered on basin'. In the systematic reorganization of local governments linked to the unification of water management, a system should be established to enhance geographical and functional links between administrative districts and basin areas of local governments.

3. Water Integration Management Plan and Business Strategy

A business strategy is needed for water integration management centered on local governments. To establish a strategy, it is necessary to gather opinions through experts. In this paper, a survey of five experts was conducted using the Delphi Method to establish a business strategy. The Delphi Method eliminates the face-to-face process of experts, which can be characterized by more free speech through anonymity guarantees and repeated feedback on opinions. This method has the advantage of being able to examine the problem coolly and objectively, resulting in a more reasonable consensus.

In this paper, we perform the Delphi Method with the following steps.

① Select experts, request participation, and develop questionnaires

- Experts were selected for five directors and senior managers with abundant experience and knowledge in the water management field related to this study.

② Researchers present their views on experts and experts present their opinions

③ Re-present the analysis results to experts, and experts re-evaluate their opinions and provide evidence for the results to form a consensus among the participating groups.

In principle, the survey shall be conducted by face-to-face, but if necessary, by e-mail or telephone.

3.1. Findings

Table 6: Main contents of interview results

Question Items	Main Opinions
■ **Growth outlook and competitiveness of integrated water management**	✓ Integrated water management growth outlook - It is difficult to prioritize growth possibilities by construction, operation management, and service sectors as they change according to government policies and changes in the water management environment - Additionally, the convergence of digital technologies is likely to grow under the current government's Green New Deal policy ✓ Competitiveness - Has strengths in various fields of business while carrying out projects such as water resources, waterworks construction and operation for the past 40 years; - Strengths in the order of business experience, technical skills, and willingness to commercialize, and weaknesses in the order of budget, law/regulation
■ **Necessity of integrated materials management centered on local governments**	✓ In the first investigation, it was deemed unnecessary to integrate local-centered water. - In the case of rivers, basin-centered integrated water management is more effective than local areas because management is required based on basin. - In the case of water supply, the connection between metropolitan water supply and local water supply is necessary, so the effect is low when promoting integrated water management centered on local governments. - If commercialization is carried out mainly by local governments, a series of processes such as investigation, negotiation, and

	commercialization by individual local governments are judged to be less effective than efforts; ✓ In the second investigation, opinions were gathered that integrated materials management centered on local governments should be implemented and further expanded to integrated materials management centered on basin. - Recognizing that basin-centered integrated materials management tends to be difficult to consult with various stakeholder. - Primary cooperation with local governments is important regardless of specific areas;
■ **Policy suggestions**	✓ Most of the projects so far have been carried out in accordance with government policies - The project is being promoted based on its exclusive status as a water-specialized institution, such as the construction and operation of dams and metropolitan water supply, operation of local water supply, and modernization projects. ✓ Self-project promotion is limited to the construction field utilizing its own facilities, such as hydroelectric power generation construction, etc., and limited to some service areas; - Most projects are based on service areas such as consulting, investigation, and safety diagnosis, and it is difficult to find additional projects after the project - Small-scale construction (modernization projects, etc.) are also being promoted, but it is based on government policy, and it has been difficult to carry out mid- to long-term projects since the project ✓ In the field of project promotion, all areas, such as construction, operation, and service, are deemed to have strengths; - Experience in implementing various water-related projects in the process of implementing government policies - In conjunction with the government's recent implementation of the Green New Deal, it also has strengths in data utilization and integration operation ✓ Short-term achievement may be achieved through mid- to long-term business discovery

	- Need to promote water integration management, driving force, and technical skills through the promotion of short-term projects led by K-water and the derivation of performance ✓ The Country/Basin Water Management Committee - If only a cooperative platform is formed, the water management unification policy can be successfully implemented. - Forming a new method/organization for linking committees and local governments

3.2 The Policy Options

Option 1. Reorganization of the Water Management Committee, including comprehensive stakeholders

At this time, the Country/Basin Water Management Committee does not include many stakeholders. Therefore, the plan includes stakeholders necessary to realize policies in the composition and operation of the Committee. There are two main options. First, it is a measure to increase the role of local governments by sharing the role of the Country/Basin Water Management Committee, and secondly, the policy to assume the authority and role of local governments by increasing the role of the Country/Basin Water Management Committee. In implementing the policy, there is always an adjustment to the role-shifting among stakeholders, and in the long run, it will have to be reasonably adjusted.

Table7: Policy option 1 evaluation

■ **Benefits**	✓ Water-related unification can be achieved on a macro level. ✓ The implementation of wealth water management policies (such as water demand management, water resource operation system advancement, etc.) is possible through coordination between local governments and stakeholders associated with the region. ✓ Stream and water management facilities can be managed in three dimensions, enabling the integration of management systems such as water resources (dams/storage/ tributary streams) quantity/water quality.

	✓ Economic benefits and synergies can be generated through the integration of water-related facilities: The scope of the project can be considered large as tributary streams/large rivers and water/ sewerage facilities are related to each other.
■ **Drawbacks**	✓ Due to many stakeholders, such as the central government and its affiliated agencies, local governments and citizens, and NGOs, it is difficult to adjust the business in a short period of time. ✓ If a new policy is adjusted without any results other than the integration of the organization, it can be seen as a failure of the policy, which is feared to cause public backlash. ✓ It may be difficult to revise the relevant Water Management 3 Act, Local Act, etc. due to concerns over possible resistance from existing organizations to expand/reduce the authority of the central or local governments.

The implementation entities of the water management unification policy are the Country/Basin Water Management Committee and the local government. However, coordinating among government organizations can be difficult in reality. However, water management cooperation is currently continuing through government-institutions, institutions-institutions and others.

For example, there is an alternative supply of agricultural water between K-water's Pyeong-rim Dam and KRC's Jang-seong Dam. As the supply of agricultural water and raw water is expected to be disrupted due to the severe drought, the drought was dealt with through the construction of a 4.0km pipe between dams that can supply 5,000m3 of agricultural water and 1,000m3 of living water per day through cooperation between K-water and KRC. Such water-related problems occur in most areas, regardless of size and size. If only a cooperative platform is formed, the water management unification policy can be successfully implemented.

In the long run, the government should pursue the unification of water management through ‘reform of the Water Management Committee’. However, based on the improvement

of effectiveness, the feasibility of policy implementation, the realization of mid- to long-term integration management, It need to pursue long-term policies based on short-term achievements.

Therefore, it is necessary to have a consensus to carry out the water management unification policy realistically and practically. It proposes a tentatively named "Water Management Integrated Implementation Council"

Option 2. Forming a new organization for linking committees and local governments

The purpose of the council is to serve as an implementation platform for the integrated water management field promoted by the Country Water Management Committee, focusing on water-related stakeholders. Basically, it is entrusted with the authority of the Country Water Management Committee to perform water-related tasks.

The role of the council is to support the planning, policy, technology, information, etc. for the concrete realization of national integrated water management, and to hold regular meetings of the Government-led Country Water Management Committee and to play a role in making major water management decisions.

In particular, the Local Government and public organization play a joint role as an executive agency for integrated material management, while the research organization plays a role in supporting policy and evaluation of integrated material management and research support.

The composition of the council body is as follows.

√ Government: State (Country Water Management Committee, Flood Control Center, National Institute of Environmental Research, etc.) and local government

√ Public Institution: Korea Water Resources Corporation(K-water), Korea Rural

Community Corporation(KRC), Korea Environment Corporation, and other agencies under the Ministry of Agriculture and Forestry, etc

√ Research institute: Korea Institute of Environmental Policy Evaluation, Korea Rural Economic Institute, Korea Research Institute of Land, Infrastructure, and Transport, and Korea Construction Technology, etc

The ‘Water Management Integrated Implementation Council’ aims to integrate water management with the basin and region. The consultative body will implement the integrated water management project and create an integrated plan through research. Then, it is possible to present a plan to unify water management by region and local governments.

The direction of operation of the consultative body is as follows.

√ Principles: Implementing future-oriented policies and supplementing policies considering the principles and characteristics of basin management in accordance with the basic principles of 12 national water management under the Framework Act on Water Management

√ The direction of operation: Realizing feasible and clear integrated water management through linkage between water management facilities, integration of information, and communication and cooperation between agencies: Realizing specific and sustainable integrated product management through a series of repeat processes of water management cycle, such as investigation, planning, execution, management, evaluation and feedback

Table8: Policy option 2 evaluation

■ **Benefits**	✓ Initiative often promotes water-related projects linked to local governments, making it easier for local governments and stakeholders to communicate and coordinate opinions. ✓ Short-term performance can be shown by solving water problems experienced

	by local governments. ✓ It is possible to establish a unified water management plan for each local government's size and characteristics, enabling economies of scale to be realized.
■ **Drawbacks**	✓ Problems such as organizational management and budget management may arise due to the formation of a new organization. ✓ Difficulties in promoting projects may arise due to insufficient authority over local governments of public institutions and research institutes.

3.3 Business Strategy

Based on the results of the investigation, an integrated strategy may be established as shown in the following table:

Table 9: Improvement Requirements and Integration Strategy

	Improvement Requirements	Integration Strategy
Water resource field	Need to operate hydrologic observation facilities for rivers and establish governance among local governments	Expansion of hydrologic observation facilities and establishment of an integrated water information sharing system to enable integrated water management throughout the river
Waterworks field	Integrated management of water supply facilities (waterworks and intake/pressure stations) in the region is possible, but insufficient connection between metropolitan and local water supply	Establishment of integrated regional (provincial) management and remote monitoring and support systems;
Water Resources-Waterworks Linkage	River water quality forecasting should be led for water resources-waterworks connection, but it is not used in the waterworks field.	Establishment of a comprehensive operating model for predicting, analyzing, and responding to demand from water sources to users;

Others	- Establishing a driving force for business expansion, - Establishing a system(law, regulations) for integration	- Develop a business model to develop into domestic and international commercialization - Technology solution advancement Expanding Future Technology

Integration between elements of each field should be prioritized for regional-based integrated water management, and the ultimate goal is to develop and manage a comprehensive operating model linking multipurpose dams, rivers, wide-area water supply and local water supply. In addition, a plan to establish governance and improve systems is needed to resolve conflicts between various stakeholders and institutions due to the expansion of new projects and areas of work. For this purpose, a short-term (2 to 3 years) and medium- to long-term (5 years or more) business strategy shall be established.

3.3.1 Short-term strategy (2−3 years)

It is necessary to have a consensus to carry out the water management unification policy realistically and practically. It proposes a tentatively named "K-water Water Management Integrated Implementation Promotion Team"

The promotion team should push for pilot projects to present an ideal integrated material management model suitable for integrated strategies. In the short term, K-water can propose policies to local governments entrusted with it, and it is necessary to push ahead with the goal of producing results as shown in the following table.

Table 10: Example of Business Objectives

Qualitative Effects	✓ Stream can be effectively managed by integrating the management system of the quantity/quality of water resources (dam/lake/river) of local governments ✓ The government's water management policy (water demand management, water resource management system upgrading, etc.) can be implemented ✓ Economic benefits and synergies can be generated when integrating water resources and water and sewage systems because river/weather, water usage, and sewage throughput are mutually related
Quantitative Effects	✓ Labor cost reduction: Cost reduction is possible through the integration of manpower for the operation of scattered facilities and the proper relocation of management personnel. ✓ Reducing water supply production costs: It is possible to reduce production costs, facility improvement costs, etc. by analyzing the usage patterns of local governments and flexible adjustment of water intake/water quality/drainage according to current conditions (weather, water quality, etc.).

It also needs to push for mid- to long-term plans such as development of water integration models, legislation, and technology enhancement.

In addition, research on the unification of regional-based water management shall be conducted. The current water management unification policy was centered on the basin (Han River, Nakdong River, etc.) and lacked a small-scale local government-centered review. Therefore, an integrated survey and integration plan for the management of aggregates by local governments alone and locally adjoining local government units should be established first. Through this, the implementation tasks of a more realistic water management unification policy can be established. The main points are as follows.

◈ A complementary study of national Unification of Water Management policy

- Analysis of the policy and political impact of national water management on the

Water management of local governments

- A Technical Feasibility Study on the Influence of Local Government Water Management (Stream, Water Supply and Quantity Measurement Network) on National Water management

◈ Economic Feasibility Analysis of Unifying Water Management in Local governments

◈ A study on the unified method of water management of local governments

- Categorization by population, water management status, and regional characteristics of local governments nationwide

◈ Suggesting a unified water management plan for each local government applying the local government classification and evaluation criteria

- Developing economic, technical, institutional and political evaluation criteria for unified water management by local governments

- Suggesting a unified water management plan for each local government

Research should be conducted to make it applicable to all local governments, and if it is reflected in the policy after verification of economic feasibility, it is possible to present mid- to long-term water management measures for each local government.

3.3.2 Mid- to long-term (over 5 years)

In order to implement the mid- to long-term integrated materials management policy led by K-water, mid- to long-term business models should be created based on the strategies established by the promotion team and the results of the pilot project.

The mid- to long-term business model is to invest in facilities, manpower, and budget to generate profits through business participation in the construction, operation management, and

service sectors of a series of processes from river management to water purification to allocation.

If this model can be adopted as a national water management policy in the long run, it can contribute to K-water's status as a water management institution and profit growth.

This policy should be led by the "Water Management Integrated Implementation Council".

Formation and operation of Water Management Integrated Implementation Council.

The Council should produce the results of integrated water management through cooperation between the central government (water management committee) and local governments as well as through the cooperation of the agency officials in the basin. The composition of the council needs to be divided into water circulation, water use, and water environment areas to suit the field in charge.

Table11: Consultative group

	Water-Circulation division	Water-Use division	Water-Environment Division
Public institution	K-water, KRC, etc.	K-water, Korea Environment Corporation, etc.	K-water, Korea Environment Corporation, etc.
Research Institute	Korea Institute of Land, Infrastructure and Transport, Korea Institute of Construction Technology, Korea Rural Economic Institute, Korea Institute of Environmental Policy Evaluation, etc.		
Related agency	NGOs, local residents, industrial (for public purposes)		

The Council shall implement policies in the following order: It is to promote nationwide expansion through evaluation and feedback after developing a pilot model for water management in water quality, water quality and ecology, and to realize specific and sustainable integrated water management through a series of water management cycle repeat

processes in the order of investigation, planning, execution, management, evaluation, and feedback.

Table12: Policy execution order

survey	plan	Practice	management	Evaluation/feedback
-Water balance analysis in basin unit -Monitoring of water circulation in the basin	-Establish an integrated plan for the basin unit -Extend and utilize functions	-Advanced technology for integrated water management and joint utilization -Preparing measures for integrated source of pollution in the basin	-Water demand and supply management -Management of contaminants in the basin	-Assessment of quantity, water quality, aquatic ecology goals and indicators and feedback

Council can create a direction for the Country/Basin Management Committee to move forward in the long term and supplement its water management unification policy. Through this, the government will be able to manage rivers in three dimensions through the integration of the management system of water resources (dams, stream, etc.) under the jurisdiction of the local government, enabling the implementation of the government's policy to unify water management.

4. Conclusions

4.1. Key research conclusions

4.1.1. Problems of supplementation of current water management unification policies

The current water management system has been difficult to manage efficiently due to differences in administrative districts and river units.

In addition, there was a problem in which it was difficult to coordinate water management plans of central and specialized institutions and local governments, and the opinions of stakeholders such as residents/social organizations were not reflected.

4.1.2 Complementary direction of water management unification policy

In order for the unification of water management to succeed, it must seek ways to serve as a bridge between central and local governments. This should be led by the Country/Basin Water Management Commission, which launched as a unified water management policy, and the committee should shape policies to solve water/water problems in the region, solve water problems between regions, establish long-term water policies, and revitalize water-related industries.

4.1.3 Integrated water management project strategy centered on local governments

It is necessary to integrate water management and solve water problems through the establishment of organic governance between local governments.

Integration between elements of each field should be prioritized for regional-based integrated water management, and the ultimate goal is to develop and manage a comprehensive operating model linking multipurpose dams, rivers, wide-area water supply and local water supply. In addition, it is necessary to establish governance and establish a system to resolve conflicts between various stakeholders and institutions due to the expansion of new projects and areas of work.

The ‘K-water Water Management Integrated Implementation Promotion Team.‘ shall be operated in the short term to establish integrated materials management strategies and produce short-term results. In the mid- to long-term, if the "Water Management Integrated Implementation Council" is established and operated, it is possible to successfully implement integrated water management centered on local governments and the government's one-way water management policy.

4.2 Additional Suggestions

In this paper, the direction of business strategy was presented, but more specific strategic models and technical verification simulations for integration management are needed, and more specific research processes such as economic analysis and feasibility analysis will be needed.

To this end, it is believed that even small-scale ‘K-water Water Management Integrated Implementation Team’ will be established and phased projects will be needed in the future.

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Appendix

Appendix 1. Interview questionnaire

지자체 중심의 물통합관리 방안 및 사업전략 의견조사

1 평가자 정보 확인

이 름	(서명)
연락처	(휴대폰)
	(E-mail)
소 속	
직 책	
전공분야	① 수리학 ② 수문학 ③ 수공학 ④ 토목(공)학 ⑤ 기상학 ⑥ 지질학 ⑦ 환경(공)학 ⑧ 생물학 ⑨ 도시공학 ⑩ 건축공학 ⑪ 기계공학 ⑫ 전자공학 ⑬ 지구시스템공학 ⑭ 화학(공)학 ⑮ 기타( )
물 관련 관심(전문) 사업분야	

분 야	기술 분류	기술 키워드(Key word)
건설	수자원개발	dam, water resource, water supply
	해수담수화	desalination
	상수도(일반)	water networks, purification plant, water plant, water quality
	상수도(디지털)	digital water(smart water)
	하수도(일반)	sewage disposal plant, wastewater
	하수도(디지털)	digital wastewater(smart wastewater)
운영관리	수자원	water resource
	상수도	water operation, water control
	하수도	wastewater(sewage) operation, wastewater(sewage) control
서비스	설계 및 엔지니어링 서비스	water design, water engineering
	컨설팅 서비스	water consulting service

연 령	① 30대 ② 40대 ③ 50대 ④ 60대 이상
연구/실무 경력	① 5년 미만 ② 5년~10년 미만 ③ 10년~15년 미만 ④ 15년~20년 미만 ⑤ 20년 이상

2 통합물관리 성장전망 및 경쟁력

2-1 향후(5년) 국내 물시장에서 가장 성장전망이 높다고 보시는 분야(건설, 운영관리, 서비스)는 어디입니까?

① (사유) _____

② (사유) _____

③ (사유) _____

2-2 (건설분야) 기술분류중 향후(5년)가장 성장전망이 높다고 보시는 분야는 어디입니까?

① (사유) _____

② (사유) _____

③ (사유) _____

2-3 (운영관리분야) 기술분류중 향후(5년)가장 성장전망이 높다고 보시는 분야는 어디입니까?

① (사유) _____

② (사유) _____

③ (사유) _____

2-4 (서비스분야) 기술분류중 향후(5년)가장 성장전망이 높다고 보시는 분야는 어디입니까?

① (사유) _____

② (사유) _____

2-5 국내 물시장이 성장하기 위해 가장 필요한 요소는 무엇이라고 생각하십니까?

① 기술개발(R&D) ② 해외시장개척 ③ 국내시장개방(상수도)
④ 환경규제강화 ⑤ 사업지원제도 확대 ⑥ 부품, 소재의 해외의존성 탈피 ⑦ 기타( )

3 물관리 일원화 정책의 평가

3-1 현재 물관리 일원화 정책이 성공 가능성이 어떻다고 생각하십니까?

① 매우 낮음 ② 낮음 ③ 보통 ④ 높음 ⑤ 매우 높음

↳ **3-1-1** 그 이유는 무엇입니까?

3-2 물관리 일원화 정책을 저해하는 요인(애로점)이 무엇이며, 이를 개선하기 위해 필요한 정책 또는 법제도적인 측면에서 개정되어야 할 부분이 있다면 서술해 주시기 바랍니다.

	설 명		
국내 물시장 활성화	저해요인	정책	
		법제도	
		기타	
	개선방안	정책	
		법제도	
		기타	

3-2 물관리 일원화 정책의 성공을 위해 국가차원에서 중점을 두고 추진해야 할 정책을 단기 및 중장기 관점에서 서술해 주시기 바랍니다.

※ 정책 설정, 도, 시, 군 등 지방정부, 유관기관 및 전문기업과의 협력체계, 전문인력양성, R&D 확대-시장성확보방안, 해외 시장 개척 및 진출 역량 강화 방안, 법제도개선, 지속가능한 중장기 물산업 정책의 세부추진전략 수립, 물 관련 인프라 구축 등의 다양한 관점에서 자유롭게 서술

	정 책 제 언
단기(2~3년)	
중장기(5년 이상)	

4 지자체 중심의 통합물관리 필요성

4-1 K-water의 미래를 위해 지방중심의 물 통합운영이 필요하다고 생각하십니까?

① 매우 낮음 ② 낮음 ③ 보통 ④ 높음 ⑤ 매우 높음

↳ **4-1-1** 그 이유는 무엇입니까?

4-2 ④, ⑤를 선택하셨다면, 기술분류중 어떤 분야에 K-water가 진출해야한다고 생각하십니까?

① (사유) _____

② (사유) _____

③ (사유) _____

4-3 K-water의 사업분야에서 경쟁력이높다고 생각되는 분야를 순서대로 제시하여 주시고, 어떤점에서 경쟁력이 있다고 생각하십니까? 아래보기에서 해당되는 사항을 구체적으로 작성하여주시기 바랍니다.

※ 기술, 자본/가격, 법/제도, 사업경험, 의지, 기타

① ② ③

↳ **4-3-1** 그 이유는 무엇입니까?

4-4 K-water 중심의 통합물관리 실현을 위한 정책방향/전략을 단기 및 중장기 관점에서 서술해 주시기 바랍니다.

	정 책 제 언
단기(2~3년)	
중장기(5년 이상)	