A STUDY ON IMPROVEMENT LOCAL WATERWORKS BUSINESS WITH PUBLIC PRIVATE PARTNERSHIP(PPP)

By

KIM, Hoyoung

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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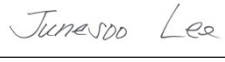
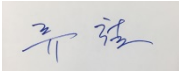
Professor Junesoo LEE 

Professor Cheol LIU 

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ABSTRACT

A Study on Improvement Local Waterworks Business with Public Private Partnership(PPP)

By

Ho Young Kim

This research paper aims to suggest a public-private partnership(PPP) scheme for local government to improve aged water supply pipe lines in local waterworks business. In 2015, 691 million tons of tap water was lost by leakage of aged water supply pipes and in terms of money, it was 60.6 billion won loss. The water flow rate, showing how much proportion of supplied tap water turns to revenue without loss while transmitting water through the pipe line is much lower in small sized cities than metropolitan cities.

Though low water flow rate is continuing problems to local governments which take charge of local waterworks business, deteriorated waterworks networks has not been improved due to poor financial condition and low expertise in local governments which is identified as main factors to affect low water flow rate among other variables

In this respect, PPP prescribed in Private Invest Act, would be good scheme to improve local waterworks by attracting private capital and advanced technologies into local waterworks business. Especially BTL is considered to be advantageous way in terms of inelastic demand of water and stability for investors.

Finally, central government should reform subsidy policy as stopgap measure, and attract voluntary participation in sustainable development of local waterworks business from local governments

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1. Introduction

Though it was short time in history, Korea water supply business has showed rapid growth and excellent performance both in water quantity and quality services. However, the local waterworks business which is under the control of local governments, have not been properly invested in improvement of the old water pipe due to poor local government financial situation. This causes about 683 million tons of tap water to leak in the deteriorated pipeline each year, resulting in losses equivalent to 600 billion won in money change. Once the water pipes become old and leaky, the level of damage to the pipes would be accelerated and the amount of water leakage will increase over time. That is why adequate repair and replacement of the old pipes is essential. However local governments suffering from financial deficits each year due to water costs falling short of production costs have been left with no facility investment available and kept compensating loss with general accounts from tax that generate annual deficits in local waterworks business instead of a fundamental solution. This is not a sustainable solution to the waterworks business, but a vicious cycle.

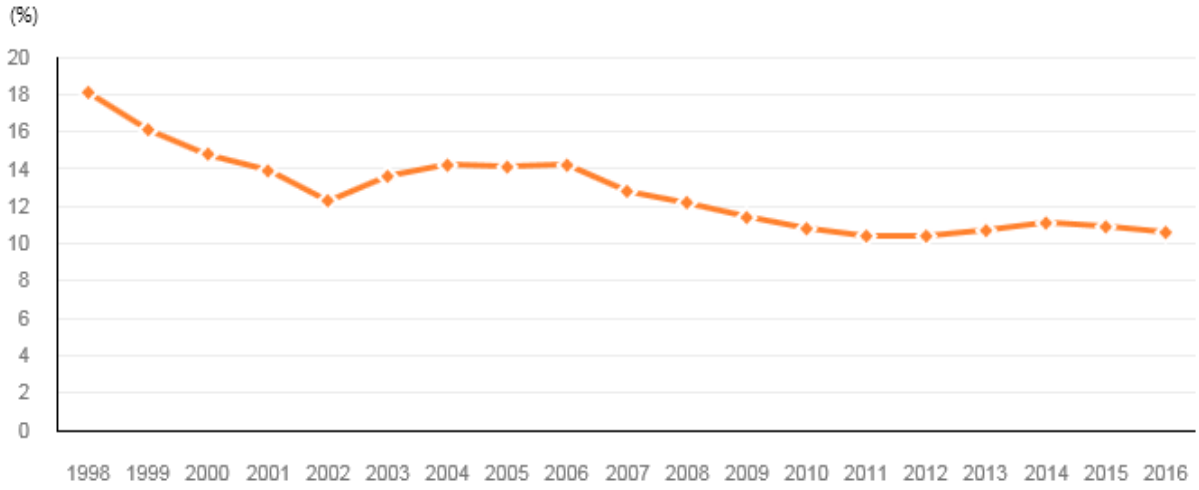
Also, local government officials in charge of local waterworks business are not like to put enough effort in renovation of their work and lack expertise in their work due to poor incentives for performance. As local waterworks departments are treated as discomfort position among the public officials, it is difficult to encourage their abilities in waterworks. In return, this reduces the operational efficiency of local waterworks business and increases water leaks and losses leading to low water flow rate in local waterworks.

Water flow rate(%) = Amount of valid water / Amount of total water supply from plant * 100

In summary, the problem of poor financial condition of local governments in the local waterworks business and the lack of expertise among public officials are main obstacle to

develop local waterworks business, and the solution of the old water leak is not being implemented showing low water flow rate in local waterworks business

< Figure. Annual tap water leakage rate in local waterworks pipes >



Source: 2016 Ministry of Environment Water Supply Statistics

On the other hands, the Ministry of Environment which control local waterworks business at the national level decided to support consignment of the waterworks business in Non-san city to K-water, public enterprise which specializes in water, to improve operational efficiency including water flow rate, which means first contract out in local waterworks business in 2004. That was a project to reduce the water leakage rate through the replacement of old water pipe with loan from K-water and to improve customer satisfaction, which is equivalent to the overall consignment of the business except for right to decide water price. Until 2018, 22 of local governments consigned the waterworks task to K-water.

In 2008, the Ministry of Interior and Security recommended the unified business bodies among neighboring local governments, including the reduction of costs through integrated management of small local administrative bodies and some of business bodies which were consigned to K-water had become unified to be integrated contract out in operation. Despite of effort to improve efficiency in local waterworks business by reducing

the leakage rate, many local governments especially small and medium sized local governments which had poor financial condition, has leaved the problem till central government did something to help them. So, the Ministry of Environment announced to launch the local waterworks modernization business and has decided to solve the vicious cycle of the water supply project through the readjustment of old pipelines and water purification facilities in 2017. This project will go on from 2017 to 2028.

However, as the project to modernize local waterworks is to improve the aged pipe lines temporarily through state subsidies, it is likely that stopgap measure will be possible, but the financial of local governments will not improve fundamentally. Of course, the selection process of modernization among candidates includes a process to give incentives to raise water price which is far lower than production cost in order to improve financial condition of local governments. But the local waterworks business is considered as a local administrative body's own task, questions arise as to whether the system can be improved to enable sustainable projects by making facility improvements depend on subsidies from the central government. Therefore, it will be possible to consider whether the problem can be solved in the form of a public private public partnership (PPP) inviting private capital and technology to local waterworks business, not through temporary central government subsidies.

Actually, in the field of local waterworks business, there are two types of consignment contract that contract out under Waterworks Act and PPP under the Private Investment. As for the consignment from Waterworks Act, it is prescribed that the waterworks business can be entrusted within five to twenty years according to the way of consignment, simple type or complex type dealing with number of facilities. On the other hand, since the Act on Promotion of Private Capital for Infrastructure took effect in August 1994, no private investment(PPP) has been made in the local waterworks sector. In particular,

even though local governments can implement the local waterworks business to improve its problem with private loan under the Private Investment Act, they prefer to use process under Waterworks Act in real fields. Local governments believed consignment by Waterworks Act would be more helpful and reliable than private investment by the Private Invest Act and they expect to get subsidies for business from central government taking passive stance to the matter. Unlike Korea in many advanced countries such as the United States and Japan, local governments actively invite private investment into water supply infrastructures with proper level of subsidies. Therefore, it is necessary to examine PPP is really more helpful to release financial difficulties in local government for long term growth of local waterworks business rather than issue the bond or other fund-raising schemes and more efficient to implement business for private sector rather than public comparator.

If PPP scheme can do positive function on solution to local waterworks business, it might be alternative way to attract fund and technologies from private for sustainable development in the local waterworks business.

2. Literature review

Until now, there is no case to adopt PPP scheme in waterworks business in Korea, researches about PPP in local waterworks are very poor. However, 26 consignments of contract out in local waterworks business were signed between local governments and water specialized public companies such as K-water and Korea environment under Water Act since 2004.

Majorities of studies tried to evaluate how much performance was improved after consignment comparing various values before contract in terms of efficiency in operating local waterworks business. However, studies that analyze the effects on local waterworks business show different results for each researcher respectively.

First of all, Won Gu-hwan (2010), Choi Han-ju·Kim Sang-moon (2011), and Ko Go-jeong (2016) said that they performed better than if they were not commissioned. But studies such as Lee Young-beom (2004) and Yoo Ji-yeon (2014) indicated that there is no statistically meaningful evidence between contract out and the efficiency of local waterworks business. In particular, Yoo Ji-yeon (2014) argued that the efficiency of local governments was estimated through data disclosure analysis and that the efficiency and the regression analysis do not significantly affect efficiency. On the other hand, Kim Eun-kyung (2014), Jang Deok-hee (2010), and Kim Hyun-ah (2015) concluded that consignment were not effective in improvement of local waterworks business.

However, there was some argument criticizing that the existing studies applied with regression analysis cannot be interpreted as an evaluation of operational efficiency by utilizing production cost, labor cost, and water rate as a dependent variable (The local water modernization business, K-water, 2017). Moreover Kim Hyun-ah, Kim Ji-young (2015), who concluded there were no did impact on improving operational efficiency by consignment,

added that there were achievements in improving water leakage and labor costs due to private consignments.

Kwon Il-woong (2012) was a prior study on economic analysis to verify the efficiency of local waterworks projects. In this study, the economic effects of regional water supply were estimated systematically by dividing the effects of fixed and variable cost reduction into the economic effects of the combined operation of local business bodies by the integration of large local water supply projects into the areas nearby.

Kim Chang-soo (2013) also said, “The integration of wide-area water supply and local water supply systems does not necessarily improve the efficiency of water supply operation”

Studies on how to secure financial situation to the local water works business were affected to estimate the cost of local water supply and to estimate the effectiveness of private loan. Moon Hyun-joo, Jung Ah-young (2015) said that we needed to establish a new cost sharing system to cope with the new service demand in the water and sewage works due to changes in the environment, such as climate change.

As discussed in the preceding studies, there were still various discussions on whether private consignments improved the efficiency of local waterworks projects, but consensus has been drawn on the improvement of the water flow rate has been increasing after consignment by 10~40% compared to those of local governments implementation. In addition, there are many opinions that integration arrangements are more efficient than each of implementation in the consignment projects to reduce costs.

On the other hands, for the financial improvement of local governments, there was research by the Korea Institute of Public Finance (2016). In the research, it was recommended that the government should grant comprehensive subsidies to expand the local governments' finances instead of specific ones in the sense that local governments are

responsible for local waterworks business. In addition, it also analyzed the need to introduce PPP scheme in local waterworks business, and analyzed that Private Finance Initiative(PFI) could be more efficient to invest than Public Sector Comparator(PSC) in value for money(VFM). However, that research was conducted in water supply facilities such as construction of purifying plant, and still not enough researches of PPP scheme about local waterworks network to improve water flow rate were conducted in Korea.

According to the KDI, Feasibility judgment in PPP is conducted on the basis of reference project which means adequate structure to make best performances, and with same condition, it would be determined which is better by compare VFM between PPP and PSC (KDI, 2009). It is required to examine whether the PPP is more advantageous than the PSC in each item by dividing the budget spent on facility improvement costs involving construction cost and serving cost such as leakage exploration service cost and operation cost, including personnel and variable costs.

In this study, it is like to compare the human resources cost in leakage exploration service cost and operation cost to increase 1% of water flow rate with real data between K-water and local government own. As K-water is also categories to public company, there is no different in winning rate of construction in bid, except for human resources efficiency

3. Current status of the local waterworks business

3.1. History of the local waterworks business in water management policy

3.1.1 Expansion quantity in water to support economy growth

The local waterworks business started in 1908 at Ttuk-seom Waterworks Company, a British company. The method of operation consisted of installing a water purifying plant, building a 90.5km water pipe, and supplying water to through 220 industrial waterways. Then individual delivery man carried a bucket on the shoulder taking water price from consumers.

However during the Korean War, majority of water supply facilities were destroyed with drop of the water supply rate falling to 17 percent and the daily consume of water per person falling to 17 liters.

In the wake of the post-war economic growth and industrialization driven by government and other public assistants such as K-water, huge development in waterworks business was archived with installation of a dual water supply system, wide waterworks supplying water to two more region and local waterworks until 1990 enjoying rapid quantitative expansion as well.

After the Phenol accident in Nakdong river was occurred in 1991 and the other chemical material contamination in the Nakdong river and Yeongsan river occurred in 1994, Paradigm Shift from quantity expansion quality management requiring government to pay attention to water pollution

The government organization who took charge of water and sewerage services have been transferred from the Construction Ministry to Department of Environment, and sooner or later, Department of Environment promoted to Ministry of Environment in 1994 which take overall responsible for managing the local waterworks business. And public concerns about water management policies focusing on expansion of supply volume were raised in

earnest as residents awareness of the environment and civic participation increased since 2000s, and water resources development policies through the construction of dams turned to be no more effective to meet public request for environment. Accordingly, the Ministry of Environment revised the 1st National Waterworks Plan as an alternative approach, announcing the 2nd National Waterworks Plan, which focused on demand management policies from 2007 to 2015.

< Table 1. The History and Major Policy Direction of Waterworks in Korea >

Time	Policy Contents	feature
1900s~1960s	-1908, Building Ttuk-seom purifying plant for the first time in Korea -1945, Supplying 27,000㎥ of water per day to 83cities, 2 million people	Expansion water supply in Quantity
1960s	-1960s, Piped water supply rate is only 17%	
1970s~1980s	-1979, Increased piped water supply rate by constructing wide waterworks -1989, Piped water supply rate extended to 79.1%	
1990s	-1991, Nakdong River Penole Contamination -1994, Promotion to Ministry of Environment and responsible for overall local waterworks -1998, Establishing 1st National Waterworks Plan	Treatment for water quality
After 2000s	-2000, Establishing Comprehensive Water Saving Plan -2007, Revising 2nd National Waterworks Plan -2010, Establishing Strategies for Promoting Water Industry, Integrated local waterworks plan -2017, Launching modernizing local waterworks business	Demand management, Improving operation efficiency,

Source : K-water 50 years

3.1.2 From supply to Demand management.

The 2nd National Waterworks Plan gradually decreased the unit water supply by demand management rather than the expansion of water supply and reducing the annual tap water supply by about 800 million tons based on the principle below

< Table 2. Principles in 2rd National Waterworks plan >

a. Water flow unit management system considering water circulation
b. Consider the economic effects of scale in the network industry
c. Reorganization, such as water and sewerage integration to maximize water resource utilization and management (introduction of the concept of distribution or district)
d. Separation of tap water production and supply functions and regulatory functions (Central government controls and supervision, public corporations or private sector participation in installation and operation of facilities)
e. Establish specialized regulatory bodies for water supply and water quality management
f. Consumer participation for fair service evaluation and transparent disclosure

The proposed structure of institution was presented in five type: local public corporations, national construction, waterworks business headquarters, local government commission, and private corporation, but most of them were not yet promoted except for consignment of waterworks business to a few public corporations.

In July 2009, the government announced the national strategy to promote water business in accordance with five-year green growth plan including the Green Growth Committee, the Ministry of Land, Transport and Environment, and tried to integrate water

business bodies based on river basin committed its own task to raise capacity of water expert public corporation as much as world best level.

Since then, the 3rd National Waterworks Plan was announced with 4 major goal targeting supply management, quality management, operation efficiency, water industry development by 2025. It was Water Saving Plan in 2000 that government decided to open the gate in public water business sector for private participants attracting many private investment and technologies. Through this plan, government tent to reduce annual water leakage by 13.5 percent of the total water supply per year in 790 million tons. According to assessment by Ministry of Environment in 2007, it was over archived by saving about 830 million tons of tap water in 2007, but this performance was result from distributing water saving machines not from improving deteriorated water pipe lines. As for the water flow rate indicator, it was not succeeded to achieve the goal failing to save as much as 230 million tons of leakage water during that span.

The integrated water bodies plan for local waterworks business, which was implemented from 2007 to 2016, put more emphasis on restructuring organization and at the same times based on pilot projects, government would expand unified operation model in local waterworks more than 4, such as south-east Jeollanam-do Province, east Gangwon-do Province, south Gyeongsangnam-do Province. Government believed that this project would save some budget by cutting down cost, with high efficiency in operation. At the end of 2014 when project would be ended, government would evaluate the performance in unified operation of local waterworks project in the point of water flow rate, customer satisfaction, and so on. The integrating project was promoted for five years from 2010 to 2014 under the Water Supply Network Financial Support Conditions Agreement between the Ministry of Environment and the Ministry of Strategy and Finance, which was concluded in 2009, granted central government subsidies to enhancing the water flow rate through optimal.

3.1.3 The local waterworks modernization project

In 2016, the Ministry of Environment announced the plan for the Modernizing Local waterworks business and decided to improve the local waterworks system in order to cut down a vicious circle through the readjustment of the old water supply network and water purification facilities.

< Table 3. Details about the local waterworks modernization project >

Contents of the project
□ Purpose : The local waterworks modernization project enables water welfare by steadily supplying clean and safe tap water to a level where it is possible to systematically manage the old water pipes lines.
□ Overview ○ Period : From 2017 to 2028 (For 12 years) ○ Expense : Total 3.1 trillion won (National subsides 1.8 trillion won) ○ Support condition : Pipe 50%~70% (different payment), Purifying facilities 50% ○ Support form : Support with regional development special account.
□ Incentive ○ Establishment of virtuous circle structure for local government to innovate local waterworks management by themselves ○ Additional support by varying the 20% limit as an incentive based on the 50% national subsidy ○ Assessment of local governments' management improvement efforts in terms of fees realization rate, investment performance, maintenance plan, etc. and apply incentives

Source : Ministry of Environment. Press release. *Begin the local waterworks modernization project*.(May, 2017)

The 17th Financial Strategy Consultative Meeting in 2016 decided to provide 1,788 billion won from central government budget for 12 years from 2017 to 2028 in the local waterworks business. The selected local governments carried out readjustment of the aged water pipes

during the five-year business period or the readjustment of the water-purifying facilities for a period of three to four years. For the aged waterworks network readjustment project, design and system construction should be carried out in one to two years in order to achieve 85% of water flow rate as final target of performance. In addition, incentives should be provided on a differential basis through performance assessment of how much local government have raised the water price to satisfy production cost every year in order to prevent persistent financial deficits and promote sustainable achievement of the project.

3.2. The Problems of the local waterworks business

The major problems of the local waterworks business are poor financial condition and lack of expertise in local governments. These two factors have been driving deteriorated water supply pipe lines and brought huge leakage of water every year.

3.2.1 Poor financial condition in local governments.

The leakage in water pipes is particularly noticeable in the small sized regions. This is because the adequate management length of water pipe line for one person is recommended as 1.96 km whiles it is 14.44 kilometers in small sized region, resulting in a relatively higher number of water leaks than big cities. So, the problem of water leakage is relatively serious as the low density populations in area require local government to construct and manage longer water pipe line leads to high production cost per ton.

< Table 4. Income statement of the local waterworks business in Korea> (unit: million won)

Category	2011	2012	2013	2014	2015
Revenue	3,3043192	3,489,817	3,618,011	3,675,720	3,842,852
Cost	3,456,316	3,614,349	3,821,859	3,963,340	4,146,229
EBIT	-152,124	-124,532	-203,847	-287,620	-303,377
Net income	-27,518	15,650	-29,912	-92,956	-86,951

Source : A Study on the Promotion Plan of Integrated Local Waterworks. *Journal water, policy, economy*. July, 2017. Vol 28. P 89

< Table 5. Water supply pipe length and purifying plant size per person in 2015 >

Category		Metropolitan cities	Middle-sized cities	Small-sized cities
Water supply pipe length per person		1.96	4.10	14.44
	Total length (thousand m)	46,404	97,595	41,710
	Water supply population (million)	2,369	2,379	289
purifying plant size (thousand ㎥/day)		377	39.4	3.6
	Total size (thousand ㎥/day)	12,442	6,941	969
	Number of plants	33176	176	269

source : 2015 Water supply statistics (Ministry of Environment, 2016)

As a result, the amount of water leakage has been decreasing since 2008, while the amount of water loss in the small sized cities has been increasing rapidly.

< Table 6. 2008~2015, Amount of water leakage > (unit : thousand ㎥)

Year	Average	Metropolitan cities	Middle-sized cities	Small-sized cities
2008	777,855	254,015	382,852	96,987
2009	708,846	233,841	378,006	96,999
2010	657,739	198,199	358,615	100,924
2011	638,310	175,153	360,001	103,155
2012	628,701	159,618	358,408	110,675
2013	626,025	135,100	372,588	118,363
2014	656,085	133,293	395,500	127,292
2015	691,274	123,482	437,147	130,645

source : 2008~2015 Water supply statistics (Ministry of Environment, 2009~2016)

< Table 7. 2008~2015, Amount of leakage loss > (unit : billion won)

Year	Average	Metropolitan cities	Middle-sized cities	Small-sized cities
2008	605,440	156,231	327,110	122,098
2009	613,400	146,640	333,643	133,147
2010	608,762	128,894	346,002	133,866
2011	595,950	112,806	327,113	156,032
2012	635,483	106,939	349,562	178,982
2013	653,068	89,670	364,346	199,052
2014	723,865	89,589	406,128	228,149
2015	787,789	88,300	452,338	247,151

source : 2008~2015 Water supply statistics (Ministry of Environment, 2009~2016)

This shows that the amount of water leakage, 43.5% and 102.4% increased during the period of specialization during the period.

< Table 8. 2008~2015, Increase and decrease rate in leakage and loss >

Increase and decrease rate	Average	Metropolitan cities	Middle-sized cities	Small-sized cities
Leakage	-5.8	-51.4	14.2	34.7
Loss	30.1	-43.5	38.3	102.4

source : 2008~2015 Water supply statistics (Ministry of Environment, 2009~2016)

As we saw earlier, the old pipe lines have a direct effect on the rate of water leakage affecting water flow rate. The variables that determine the rate of water flow vary. Intuitively, it can be expected that deteriorated water pipe are linked with poor financial conditions, number of workers in water sector, population and water fee realization rate. However, it is important to examine that these variables really affect to water flow rate and how much they affect to target in local waterworks business. The statistical determination of which of these variables most affect the rate of water is of great help in establishing policies that improve the rate of water. Also, by boldly excluding variables from the policy reflection that are less relevant to improving the water flow rate, the efficiency of policy can be increased through selection and concentration.

The Korea Institute of Public Finance conducted research for 70 middle-sized cities and 60 small cities about correlation between water flow rate and other variables such as financial independence rate, population, local taxation, proportion of elderly population, number of workers in water supply, water fee realization rate etc. The highest correlation with water flow rate was measured by financial independence and elderly population. The reason why the ratio of the aged population showed high correlation with water flow rate is similar to reason of financial independence that poor financial condition leads to skip the investment on local waterworks improvement. If there are a lot of elderly people in the city, local governments' welfare expenses are high. As for the coefficient of population, it is low

by 0.27, because luckily some of small population cities were granted subsidies from central government to improve deteriorated water pipes. Interesting thing is coefficient of 'number of workers' and 'water fee realization rate' are very small under 0.1, contrary to expectation. As for the number of workers in water sectors, it can be explained that operation of human resources in local government is very low and labor cost saving by reduction employees in local waterworks business cannot be reinvested to improve water supply facilities in local governments. And for water fee realization rate, as it has decreased 92.2% in 2003 to 81.5% in 2017 and still far below the production cost, local governments should spend money to cover the loss instead of investing facilities. Until the time when water fee become close to production cost, income from water rate will be used for operating and maintenance cost

< Table 9. The coefficient between water flow rate and other variables >

Category	Financial Independence	Population	Local taxation	Proportion of the elderly population	Others*
Coefficient	0.58	0.27	-0.34	-0.63	-0.1

(* Others : Production Cost, Employees in water sector, water fee realization rate, etc)

Source : Korea institute of public finance . "Establishment of Financial Support System for the improvement of aged local waterworks system". 2016

As for the variable "proportion of aged population" showing high relation with water flow rate, it is possible to explain poor financial investment environment caused by spending welfare budget in limited leads to less investment for improving deteriorated aging water pipe lines.

To sum up, water flow rate is highly connected to financial situation of local governments among any others variables. That means that there should be affordable support in financial policy for local government as well as central government subsidy to improve local waterworks business. Moreover it is necessary for local government to access the fund easily in timely manner.

3.2.2 Low expertise of public officers in the local governments

Another problem why local governments kept suffering from continuous water leakage are related to personnel management such as regular circulation work system in local governments.

Although highly specialized and experienced skills in tap water production and supply are required for workers, local governments currently in charge of local waterworks projects have many organizational problems in securing the expertise of waterworks. Local government employees do not have enough time to expand and accumulate their expertise because they have to leave their tasks in short times due to circulation work system. While diverse facilities and complex water networks require time to understand the experience and know-how of running a facility efficiently, the circulation work system hinders the development of expertise by forcing a short period of work. In addition, with the abolition of functional position in public officials system in 2013, personnel management became more difficult to foster professional human resources as all professionals who previously worked long-term in water management are subject to rotation. And as there is no incentive for the efficiency of operation in the water supply service, public officials in local waterworks offices are likely to transfer their position as early as possible. So, it is prevalent among public officials that the water supply departments are treated as a leisurely occupation in the organization which cause an obstacle to expertise.

< Table 10. The number of functional position in local government by year >

Year	2009	2010	2011	2012	2013	2014	2015
number	5,494	5,265	5,152	4,324	3,118	2,122	1,646

source : 2008~2015 Water supply statistics (Ministry of Environment, 2009~2016)

Also, it is difficult to establish an independent responsibility management system because the head of local governments who is elected by vote directly controls personnel or financial rights and lacks the authority of the project manager. Majority of current local waterworks business are operated in the form of a local public corporation, but the decision-making authority of the local administrative bodies are not fully independent in personnel or organization, but only are divided in accounting for general account and special account. But in the point that consistent losses of special account for local waterworks business have been covered by general account from tax, it is hard to say that special account is separated from general account. So, it is not enough to say local waterworks business are not dependent from politics and treated as specialized tasks.

In particular, the heads of local governments are selected by elections, so they are not willing to raise water fee though it is far below production cost for political popularity. They tend to prepare next election in advance, and they will set back promoting facilities for aged waterworks projects which will require long-term investment among many SOC projects.

3.2.3 Analysis of results

In conclusion, with combining two main problems, poor financial condition in local governments and low expertise of public officials in local waterworks business, it became complicated to go further to solution in local waterworks business.

If local governments are smaller in its scale, it becomes more difficult in funding itself. In 2015, local governments had a financial independence level of 66.8 percent in metropolitan cities, with 16.1 percent of them having high average financial independence. In particular, the average level of financial independence in Seoul was 88.8 percent, while that of Gangwon, North Jeolla, South Jeolla and North Gyeongsang provinces was 26.6 percent, 25.7 percent, 21.7 percent, and 28.0 percent, respectively in 2014.

< Table 11. Financial independence rate >

Category	Metropolitan cities	Middle-sized cities	Small-sized cities	Category
Rate	44.8%	61.5%	31.7%	11.4%

Source : Ministry of Interior and safety. *2016 integrated financial overview of local governments*. 2014

At the end of 2015, only about 9% of the total amount related to the commercial and sewage treatment facilities by issuing local bonds. The loans available to local governments when issuing special local bonds are government and local government funds, local government funds, foreign currency funds, financial institutions, recruiting public funds, and the principal loans related to the water supply project. The public management fund and the environmental special funds have interest rates of 3.0 to 5.0% and the regional development fund of 3.0 to 4.0% per annual basis. The local government debt was large enough to reach about 1.1 trillion won in 2016, and the central government begins to take a stance such as limiting the issuance of local bonds, which makes it virtually difficult to issue additional local bonds. This means that local governments are more likely to rely on state subsidies than on their own financing in the local water supply projects, and their requests are likely to continue to rise.

However, the local waterworks business has been carried out under the classification of local governments as their own work, it is difficult to provide subsidies to support their own business and moreover basis for support is weak. Indeed, the central government support for the waterworks business remains at about 6 percent in 2016, which requires consideration on how to procure its own resources other than local bonds and state subsidies.

3.3. Financial support plan for the local governments

As we saw above, the water supply improvement project is difficult to implement considering poor financial conditions of the local governments and the low water fee realization rate make it difficult to resolve problems in a short period of time, such as political problems of the head of local governments and parliamentary approval. In addition, it is also difficult to issue the local bonds in terms of growing concerns over local governments increasing debts.

So, in April 2015, the Ministry of Strategy and Finance announced the revitalization of the private investment business as a way to solve such poor financial problems, and proposed measures to recover the economy and secure stable investment by utilizing spare funds from the private sector to expand investment on SOC.

There are several funds which can be affordable support for poor local finance.

3.3.1 River Fund

The River fund can be considered as a way to finance the project. According to the Act on Water Quality Improvement and Resident Support of Han River Water Supply System, 1) for the purpose of funding, and 2) for the establishment and operation of wastewater discharge facilities by Ministry of Environment, funds can be used.

Article 22 sub-paragraph 5 of the Act requires additional business items to be added in order to continuously invest in water supply facilities. However, the amount of non-use and carry-over of the four-river project is expected to be about 8.5 billion, which is unlikely to secure high effectiveness in water supply projects that require large-scale facility investment, as the amount is small.

< Table 12. Water management and Resident support Act, Article 22 >

Article 22. The use of the River Fund
1. Purchase of land, etc. under Article 7
2. Community support project
3. Supporting the operation of water pollution prevention facilities under Article 12. 2
4. Supporting the installation and operation of the environment-friendly facilities pursuant to Article 13 paragraph 1 and 2
5. Participating in Special Accounts
6. Support expenses for imposition and collection of water utility charges
7. Operation of the Han river Management Committee under Article 24
8. Supporting the costs necessary to fulfill the improvement request pursuant to article 28. 1
9. Support of eco-friendly clean industries
10. Other projects designated by the Presidential Decree for water quality improvement

3.3.2 Project Financing

Project Financing(PF) is a financial technique that provides the funds necessary to carry out the project with future cash flows secured from a particular project(Jo and Park, 2008). In addition, PF is a future cash flow that arises from the various projects independent of the employer, unlike traditional corporate finance or loan based on the security or credit of the employer. Since PF was launched in 1995 under the Private Investment Promotion Act, and recently the Incheon International Airport Highway was growing at 1.3 trillion won as PF, and it has recorded continuous growth since 2000 when it recorded a record of 900 billion won in Seoul Outside Circulation highway and Cheonan-Nonsan Expressway investment project of 90 billion won suitable for PF would attract a lot of money to invest in the project. Even though PF requires a lot of money in initial stage of project, operation would not incur

significant costs and stable sales. PF has the following advantages and disadvantages: First, the benefits are the characteristics of off-Balance Sheet Financing, which provides accounting benefits that do not affect the credit worthiness of the business owner's parent's financial position statement. Second, the contract between the employer and the majority shareholder allows the project to be properly distributed. Finally, PF can be used as a means of avoiding various constraints that constrain the business owner, so that it can be funded if the requirements in PF are good even if the business owner does not meet the credit requirements.

However, PF has the disadvantage of obtaining contracts through complicated procedures because the additional financial cost is calculated higher than the existing method and the participation in risk sharing instead of transferring risks to the operator. PF is equivalent to a general loan, but differs only from the fact that several financial institutions finance a large consortium and invest in a business rather than the business owner, so PF can be applied to the waterworks business and considered a financing plan.

3.3.3 SOC Bond

SOC bond is special purpose bonds issued to fund the construction of infrastructure for social overhead. SOC bonds were established through the revision of the Private Investment Promotion Act 1997 and project implementers and financial institutions were required to procure funds for private investment projects ("to repay debts due to private investment projects"). The issuers of bonds are project implementers who have signed a contract with the relevant government office, state-run banks such as Industrial Bank of Korea and commercial banks. The issuance of SOC bonds is relatively low, as loans by financial institutions account for the financing of SOC projects. As an actual case, SOC bonds worth 1.4 trillion won have been issued to businesses such as Daegu-Busan Expressway since the Industrial Bank of Korea first issued 100 billion won in non-guaranteed bonds for the civilian development

project at Incheon Airport in 1999. SOC bonds worth 200 billion won were also issued for the Pocheon Thermal Power Plant project.

An advantage of SOC bonds is that they provide financial incentives for separating interest income. Currently, interest income on long-term bonds is 30 percent for longer than 10 years, but tax rates of 14 percent are applied under section 29 of the Act on the Restriction of Special Taxation on Social Infrastructure Bonds. Although SOC bonds were highly anticipated as a financing plan for private investment projects, they have not been widely used in domestic long-term bonds due to the expected tax benefits for long-term investments. On the contrary, it is likely to lose flexibility in business, because in order to change expenditure plan it is necessary to get approval in advance from all the stake holders such as government, business operators and financial institutions.

According to Article Private Investment Act on Infrastructure, as issuing SOC bonds does not impose any special restrictions if the issuance and use of such bonds is intended for private investment projects, it is possible to use in local waterworks business.

3.3.4 Asset -Backed Securities (ABS)

Asset-Backed Securities(ABS) is a financial procurement technique that is used to issue securities based on assets and sell them to a number of investors (Park and Kim 2006). ABS is issued through the process of transferring legal ownership of the underlying asset by establishing a liquidation company by the holder of the asset. Liquid assets are recognized with almost no restrictions on assets that can generate cash flows from bonds to real estate assets and property rights. As the asset liquidity market evolves, the type of asset that can be liquidated is expanding, but in order for the asset to be liquidated, the asset must be a liquid asset in the form that can be achieved, so called True Sale.

A case in Korea that applied asset flow technology to SOC private equity projects was the first case in 2001 when the Industrial Bank of Korea issued asset flow securities to the private equity project of Cheonan- Nonsan Expressway.

However, under section 2 of section 2 of the Act on Asset Liquidity, local public corporations cannot raise funds by issuing ABS as a direct asset holder because they do not belong to the owner of the asset.

3.3.5 Infrastructure Fund

Infrastructure funds are funds that are designed to invest and finance various infrastructure projects based on the Private Investment Act on Social Infrastructure and distribute their profits to shareholders (Jo and Park, 2008.

Infrastructure fund asset management firms will find infrastructure suitable for investment, draw funds from institutions and individual investors, and the funds raised will be executed by investing interests in infrastructure project operators or executing loans. It is analyzed that the fund's return is linked to facility fees, which can cause inflation risk to be overcome, and that it has a low correlation with traditional financial assets, stocks and bonds, which can spread the risk of portfolio investment.

In 2010, the Green New Deal No.1 fund was not used widely as the local bond interest rates for three year were 4% infrastructure fund interest rates were 5 % annually. But there are no constraints on usage of infrastructure funds if it can be used for the purposes of the waterworks infrastructure

3.3.6 Build-Transfer-Lease(BTL) and Build-Transfer-Operate(BTO)

BTL is a method of building infrastructure and transferring ownership to the state after it completes it as private capital, and leases the management rights of the facility it receives to

the public to preserve investment expenses. In other words, at the time of the completion of the facility, the private operator obtains the right to use the facility and reflects the rate of return paid by the government for the promised period. .

BTO means building infrastructure with private capital such as BTL and transferring ownership to the state, but the private operator does not receive a certain rate of return from the government. In case of BTL, facility rents are set up based on a defined rate of return over a given period of time, therefore, the business risk of carrying out the same business is lower than that of BTO and this eliminates private demand threats. The downside is that the collection of investment costs through the government's facility rental fee can increase the nation's fiscal burden. BTO has a higher return than BTL, but there is a high risk in operating income as a result of the private operator's direct return on investment from end users.

In order to share the risk while operating business, BTO and BTL were implemented in a mixed form according to the rate of risk sharing.

BTO-rs(risk-sharing type) allows private investors to share risk with local governments by sharing risk at 50% level with the relevant authorities and businesses, thereby lowering the return on business and service charge.

BTO-a(early shared with profit or loss) is the method that local governments maintain only a portion of the minimum business operating expenses and in general the losses and profits are shared by local governments at 70%

3.3.7 Summing up

As affordable finance supports which are accessible for local governments are insufficient at present, many urgent facility investment projects have been put on hold. Except for river fund of small scale and ABS of ownership problem, other funds can be considered as complementary financial support to enhance capacity building for local governments in local waterworks business.

Based on the Private Investment Act, sewage treatment plants have been mostly driven by BTO and sewer pipes by BTL. With same reason, it seems possible to activate investment by BTL in case of local waterworks network improvement. Although the local waterworks business is user-charge system, BTL looks more appropriate for local waterworks business in terms of risk sharing.

Then it should be considered whether it is possible to adopt PPP into local waterworks business in Korea legal system, and which types are adequate in implementation of PPP in the local waterworks business. It will be described in more detail in the next chapter.

4. Study on PPP of the local waterworks business under Private Investment Act

Until now, there is no case of PPP in local waterworks business. So it necessary to examine PPP is possible in Korea law system. If possible, found out which is appropriate scheme for local waterworks business.

4.1. Comparison between Waterworks Act and Private Investment Act

The Act on Promotion of Private Capital was enacted in August 1994 and amended by the Private Investment Act 2005. The Private Investment Act stipulates that private investment projects are applied preferentially to other related law and larger projects of more than 200 billion won are designated by the committee of private investment review headed by the Ministry of Strategy and Finance (MOSF) and also other the related governments is in charge. In addition to the government's public announcement projects, the private sector can suggest private investment projects to the government as private-proposed projects.

The private investment consignments are different concept than consignments of the contract out by Waterworks Act which had been major streamline of local waterworks business since 2004. The differences between Waterworks Act and Private Invest Act on the consignment of local waterworks business are as follows.

< Table 13. Comparison between Waterworks Act and Private Investment Act >

Regulation (Ministry)	**Waterworks Act (Ministry of Environment)**	**Private Investment Act (Ministry of finance and strategy)**
detailed regulations	Regulations for Operation and Management of Waterworks (Ministry of Environment)	Master Plan for Private Investment Projects (Ministry of Finance and Strategy)
Introduced year	2001	1994
Business type	Simple consignment, Complex consignment	BTO, BTL, BOT, BOO and other private sector proposals which Method that has been adopted by the relevant
Business target	Improvement of water supply facilities, consignment of substitute work, consignment of water supply and drainage facilities	All facilities that supply raw water or purified water using pipes including normal, industrial, dedicated waterworks
Business focus	The focus on improving the water flow rate through facility improvement and operating management rather than new facilities	Focus on facility improvement and supply of new facilities
Receipt of fees	Collection rights are not consigned	Using payment in BTO or government rental fee in BTL
Review of the necessity and feasibility	Conducted by consignor	PIMAC
Right to buy	No regulation	It is possible if unavoidable reasons or management is not possible
Business period	Within five or twenty years	Cannot exceed 50 years maximum
Imputed ownership	Local government authority	Diverse according to business type

The main characteristics about contract out by Waterworks Act is that it focus on water supply business and management, but restricts a bidder as civil engineering and engineering design license, threating fair competition will be hindered. On the other hands, PPP under the Private Investment Act include a variety of financial assistance, loans and tax support, but the implementation process is complex and cumbersome.

Until now, most of consignments by Waterworks Act were signed as contract out, which were entrusted by all duties related to local waterworks except for water fee decision authority. And contracts are long-term of 20 years. So, the local governments who considered the contract out worried about reduction of organizations, and reluctant to make contract leaving the problems attended. Since contract out requires lot of budget to implement projects, it takes much time to get approval from local councils, and should overcome opposition of residents.

Therefore it is necessary to make project simple, concentrating on improvement of finance condition and aged waterworks networks to move on to next page. So, by using flexibility leverage in PPP, it would be possible to realize PPP project in local waterworks business satisfying various stakeholders such as the local government officers, local council and citizens.

4.2. Review on PPP schemes appropriate for the local waterworks business

As it was mentioned previous, there are many PPP schemes in infrastructure projects, and most of sewer projects similar to waterworks supply projects have been implemented as BTL scheme. Though local waterworks business is operated by collecting user fee from customers, not like tax, BTL is more appropriate for business in sense of risk management. First, tap water is essential for living with low demand risk. Water is kind of public good, and local governments will reserve the right to determine the water price, not like BTO. Secondly, as

most of facilities are underground pipe lines with high possibility of management risk, the investors prefer more stable scheme rather than high return with high risk. In the BTL, the local governments guarantee stable benefit for lease of facilities.

However, as for the BTO, adjusted schemes were appeared like BTO-a, BTO-rs, sharing the risk between public and local area.

< Table 14. Comparison among the PPP schemes >

Scheme	BTO	BTO-rs	BTO-a	BTL
Rate of benefit	Nominal 5%	Nominal 3%	Nominal latter 2%	Nominal middle 2%
Risk sharing	None	50% of Total investment	70% of Total investment	1000% of Total investment
Demand Risk	100% : Investor	50% : Investor, 50% : government	Up to 70% : Investor, Over 70% :government	100% : Government
Bankruptcy Risk	Very high	Middle level	Almost zero	Almost zero

In fact, a demand survey for 119 of private investors about preference among PPP schemes, conducted by the Korea Institute of Construction and Industry showed that private investment is preferred in low-risk ways.

Private investor preferences	BTL > BTO-a > BTO-rs > BTO

In particular, the preference for BTO-a for environmental facilities such as waste water treatment plant and purifying plant. Details are as below:

< Table 15. Preference of private investors by PPP schemes >

Scheme	BTO	BTO-rs	BTO-a	BTL
Environmental Facilities	31.9%	14.2%	22.0%	31.9%
Road	38.8%	21.4%	27.2%	12.6%
Rail Road	4.1%	39.8%	30.6%	25.5%
Port	9.4%	28.2%	31.8%	30.6%
Architecture	13.3%	6.7%	4.0%	73.3%
Sum	97.5%	110.3%	115.6%	173.9%

Source : Construction and Economy Research Institute. questionnaire survey. 2016

4.3. Summing up

Though majority of outside investment to local waterworks business were implemented as forms of contract out, regulated by Waterworks Act, it is possible to participate in forms of PPP by Private Investment Act. It would be easy to satisfy various stakeholder related to business by using flexibility in PPP schemes while launching the project.

In the regard of characteristics of tap water, BTL is more appropriate for local waterworks business in terms of demand and operation risk, and right to decide water fee than other BTO schemes.

5. Study on the feasibility of the local waterworks business through PPP

The feasibility study of BTL looks into economic and policy feasibility caused by the project implementation and analyzes whether it is superior in terms of Value For Money(VFM) when implemented in Private Finance Initiative(PFI) against Public Sector Comparator(PSC) promoted by government shareholders (KDI, 2009). Therefore, it is desirable to review the improvement project of local waterworks business with BTL as PFI, especially in terms of quantitative and qualitative aspects, when the project is carried out as PSC.

5.1. The procedures for feasibility study and private investment qualification

The sequence of verification for feasibility in projects that improve water flow rate in local waterworks business is as follow :

1. Decision to invest → 2. Decision to PFI → 3. Building an alternative for PFI

5.1.1 Decision to Invest

For Decision to Invest, economic and policy feasibility is analyzed based on judgments about the benefits or urgency expected to be expected to be implemented. In the case of economic feasibility, it is deemed reasonable only if B/C is at least 1 by comparing the benefit and cost.

In the case of determining policy feasibility, the necessary items of judgement include the need for the project, the possibility of funding, and the consistency of the policy and the willingness to promote it. Also optional are regional balanced development and ripple effects. Move to step 2 if "Decision to Invest" is fulfilled in step 1, otherwise projects will be rejected.

5.1.2 Decision to PFI

The "Decision to PFI" judgment is a VFM analysis and is performed with quantitative and qualitative analyses. Quantitative VFM analysis is for comparing PSC and PFI in terms of Life Cycle Cost(LCC). If the government's burden on PFI is less than the PSC, it will pass the test that there is VFM.

5.1.3 Building an alternative for PFI

The third step, "Building an Alternative for PFI," provides an appropriate discount rate by analyzing the business practice conditions through a financial analysis based on the PFI. Check the possibility of obtaining private investment eligibility in this step, even if it is judged to be unqualified in "Decision to Invest". The data analyzed at this stage can be used as a reference during the project promotion process.

5.2. Condition to make same VFM value between PSC and PFI

5.2.1 Overview

If the total investment costs of the PSC and PFI are the same, and all of them can be procured from their own capital and the VFM can be achieved except for the operating costs. Suppose both the PSC and PFI have the same total cost of doing business as 100. This would be evenly distributed over two years, with an annual inflation 3% of 110.4. The PSC obtains this through an annual interest rate of 5% and pays back after five years. The PFI pays rent based on a yield of 6% per annum based on this amount of principal assuming that there is no construction interest. The PSC's total current expenditure is 138, which is discounted at 6% to

88.8. In the case of PFI, a total rental fee of 192.5 is paid for 20 years, and converted to present value would result in 90.1, which would not achieve the VFM of the PFI.

Despite these same investment costs, the PSC present value is smaller than the PFI present value because of the difference in funding interest rates. Interest rates in PSC are half as much as 5%, but PFI pays rent based on a yield of 6%.

In reality, the difference between the PSC present value and the PFI present value becomes even greater when the current total cost of the business is equal, since the equity ratio is not 100%. Therefore, the total private investment and rental fee increase. Table shows that the present value of PFI increases to 94.5, assuming an equity ratio of 10%. We can see that there is a further gap from the value of money. After all, the PFI has to reduce total project costs sufficiently to overcome shortcomings in funding to achieve VFM.

< Table 16. Condition to make same total cost between PSC and PFI>

	Nominal Total cost	Real Total cost	Equity ratio	Private investment	Cost of capital	PSC payout	Rental fee	Present value
PSC	100.0	110.4			27.6	138.0		88.8
PFI	100.0	110.4	100%	110.4	0.0		192.5	90.1
PFI	100.0	110.4	10%	115.8	5.4		202.0	94.5

Source : Audit and Inspection Research Institute, 2011

5.2.2 Consideration factors to make same VFM of PFI with PSC

Based on the standard assumptions established earlier, it is necessary to either reduce the total project cost or reduce the capital cost of PFI. So, competition among operators and the introduction of new methods are essential to reducing construction costs. It is also necessary to efficiently reduce the share of capital in PFI through support of external funds such as government grants.

< Table 17. Condition to make same VFM between PFI and PSC >

	Nominal Total cost	Real Total cost	Cost of capital	PFI Total investment	PSC Total investment	Present value
PSC	100.0	110.4	27.6			88.8
PFI	93.97	103.7	5.1	108.9	192.5	88.8

Source : Audit and Inspection Research Institute, 2011

5.3. Case Analysis

5.3.1 Method of Analysis

As previously discussed, the benefits are significant in that water loss due to water leaks continue to occur each year, which is covered by taxes, and in the case of small local sized local governments, water leaks and tax losses are more severe, it will be omitted to analyze economic and social effect by the first step.

What's important is whether there is a VFM compared to the PSC when the water flow rate improvement project was implemented in the form of PPP(PFI). As for the VFM, suppose that lists of cost except the construction cost including exploring water leakage service cost are same based on K-water, the public company carrying on business as PFI. The analysis method calculates from PSC and PFI the costs spent to increase the water flow rate by 1% respectively, and analyzes whether there is a VFM among similar area with population using water. Given that the problem of leakages and old-age pipes usually occurs in small-scale area, cities with less than 300,000 population using water would be analyzed, and to produce more accurate consequence, analyze less than 200,000 population using water cities, too.

In addition, it will be targeting the government which actively invest budget to improve the water flow rate by more than 5 % within the period of time.

The comparison method of costs estimates the VFM by calculating the construction and service costs of the investment budget injected to improve the unit water flow rate by 1%.

The comparison will be implemented based on cases real cases. But since there is no case of improvement of the water rate under the Private Investment Act, contract out to K-water cases will be used as for PFI. In the project by K-water, since majority of budget are put into within starting 5 years to reach the target rate 80%, and there were many contracts signed till 2010, it will be analyzed base on 2013 when the five-year project cases are abundant.

Therefore, from 2007 to 2013, comparing how much budget was put into to improve 1% water flow rate between PSC and PFI among 300,000 and 200,000 population using water groups

< Table 18. Conditions for analysis >

Category		Contents
Time	5years	2007~2013
Condition of Target Cities	Water user population	Group A : less than 300 thousand Group B : less than 200 thousand
	Water flow rate improvement	More than 5% during the time
	Operator	PSI : Local government, PFI : K-water by contract out
Cost	Construction cost	Budget to improve water flow rate by 1 %
Method	VFM	Comparison Arithmetic mean between PSI and PFI

Lastly, to verify the VFM is appropriate coming from analysis, comparing results to average VFM values in other infrastructure projects

5.3.2 Analysis of real case

Local governments with a water supply population of 300,000 or less selected 21 cities. Among them, 18 local governments directly promoted the water supply rate improvement projects, and 4 were carried out by K-water.

< Table 19. List of target group A (300,000 or less water user population) >

Operator	Local government	K-water
City	Gyeongju, Chungju, Gwacheon, Gunam, Yeongam, Andong, Mokpo, Gimcheon, Gapyeong, Haman, Pyeongchang, Umsung, Chilgok, Jechon, Buan	Geoje
Number	17	1

Source : 2007~2013 Water supply statistics (Ministry of Environment, 2008~2014),

2007~2013 Financial management system data (K-water, 2008~2014)

During 5 years, sum up all budget as construction and service cost to improve water flow rate and divide by increase value of water flow rate to calculate unit cost to improve 1% of water flow rate by each operator.

< Table 20. Target group A analysis(300,000 or less water user population) >

Category	Water flow rate(%)			Construction cost (thousand won)	Cost for 1% improvement	Remarks
	2007	2013	Gap			
Local government(a)	65.3	73.5	8.2	9,736,509	1,189,977	Arithmetic mean
K-water(b)	59.9	80.5	21.4	1,7175,848	803,077	Arithmetic mean
Gap(b-a)	△5.4	6.7	13.2	7,439,339	△386,900	

Source : 2007~2013 Water supply statistics (Ministry of Environment, 2008~2014),

2007~2013 Financial management system data (K-water, 2008~2014)

Comparing the construction costs of local governments' businesses over the past five years and K-water's projects over the same period, K-water invested about 7 billion won more than each local governments, with 13.2 percent of higher water flow rate improvement. For the

cost used to raise the rate by 1%, local governments spent 1.19 billion won on average, but K-water used 0.80 billion won, resulting in a cost-effectiveness of VFM.

In the case of water user population of 200,000 or less, 22 targets were selected and14 were local government running business, 8 were K-water running business as operator.

< Table 21. List of target group B (200,000 or less water user population) >

Operator	**Local government**	**K-water**
City	Chungju, Gwacheon, Yeongam, Andong, Gimcheon, Gapyeong, Haman, Pyeongchang, Anseong, Voice, Jeongseon, Chilgok, Buan	Nonsan, Jeongeup. Yecheon, Sacheon, Seosan, Seosan, Aging, Geumsan, Dongducheon
Number	14	8

Source : 2007~2013 Water supply statistics (Ministry of Environment, 2008~2014),
2007~2013 Financial management system data (K-water, 2008~2014)

< Table 22. Target group B Analysis (200,000 or less water user population) >

Category	**Water flow rate(%)**			**Construction cost (thousand won)**	**Cost for 1% improvement**	**Remarks**
	2007	**2013**	**Gap**			
Local government(a)	66.5	75.1	8.6	7,318,092	846,862	Arithmetic mean
K-water(b)	63.4	80.2	16.8	13,186,878	786,077	Arithmetic mean
Gap(b-a)	∆3.1	5.0	8.1	5,868,787	△60,785	

Source : 2007~2013 Water supply statistics (Ministry of Environment, 2008~2014),
2007~2013 Financial management system data (K-water, 2008~2014)

Comparing the construction costs of local governments' businesses over the past five years and K-water's projects over the same period, K-water invested about 5 billion won more than

each local governments, with 8.1 percent of higher water flow rate improvement. For the cost used to raise the rate by 1%, local governments spent 0.85 billion won on average, but K-water used 0.79 billion won, resulting in a cost-effectiveness of VFM.

5.2.3 Result

In order to find out whether VFM is secured when the local waterworks improvement project is PPP for small and medium sized local governments, it is necessary to calculate the costs from the PSC and PFI incurred to increase the rate by 1% and compare them. In particular, K-water, which is assumed to be PFI, has the advantage of accelerating the improvement of old pipelines by creating blocks for each water supply zone at the beginning of the project. In addition, the real-time monitoring of each block can save the cost of leak detection and prevent loss of construction costs due to detection errors by observing volume of midnight usage in each block area when there is no water usage.

However, in general, it is difficult to measure the cost of improving the water flow rate because each local government has a number of structural differences, such as the length of the pipe line, the level of age in facilities, and the total water supply volume, and so on(Korea Research Institute for Local Administration, 2012). Especially, calculating the cost of increasing the water rate by 1% based on the difference in the input budget has limitations in the accurate analysis. In the future, it is expected that more accurate results will be obtained if the local government sets the dependent variables as the construction cost of the improvement project, sets the independent variables as the water flow rate, and sets the other variables as the control variables

6. Conclusion

Tap water is continuously leaking from the old building. However, local governments in charge of local waterworks are reluctant to solve the problem due to poor local finance and are waiting for subsidies from the central government. Meanwhile, the loss of tap water is being covered by taxpayers' money. Although the local waterworks business has been suffering from a fiscal deficit every year due to low water fee, it is not easy to raise the price due to public resistance. The small provincial government continues to solve the problem by adapting to the current situation. Therefore, if local governments have more financial resources to use in addition to issuing local bonds, the problem will be solved more quickly. If a SOC fund or PF are well formed, it will be able to leverage the finance's leisure to bring greater welfare benefits to the people.

In addition to increasing the financial availability for investment, it is also important to secure innovation and advanced technologies. Due to the circulation of public officials, and as small companies are often in charge of each region, technology development may be delayed.

So, PPP scheme, especially BTL will be a good proposal to solve the local waterworks problems. It is expected that the problems of finance and technology can be solved at the same time, and the domestic water market can be revitalized through PPP scheme. However, for the improvement of the local water aging system through PPP, the following needs to be done.

The central government should support the activation of PPPs in local waterworks through state subsidies. Allowing only a small number of local governments to benefit from state subsidies with limited budgets, such as the current modernization project, would not help strengthen local governments capabilities in the long run. It should support the cost of project diagnosis to suggest projects to local governments through subsidies and support a

certain portion of the project cost to make the structure mutually win-win for local governments and private investors.

Also, water-specialized institutions such as K-water and the Korea Environment Corporation should be supported to serve as bridges in the middle because of concerns about introducing private investment into public goods despite the efficiency of PPP.

Finally, to facilitate efficient private investment, the integrated management among neighboring local governments in similar environments are needed to reduce the cost and increase benefit. With activate infrastructure investment in poor condition through PPP, it is possible to increase the public welfare.

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