Enhancement of Revenue Water Ratio in Korean Waterworks, 2001–16

Introduction

Between 2001 and 2016, the government of the Republic of Korea made national efforts toward a comprehensive modernization of the water supply system to reduce water losses within the system. In 2001, the Korean government revised the Water Supply and Waterworks Installation Act and Operational Rules on Waterworks Revenue Water Ratio Enhancement (Ministry of Environment 2001), the document that governs the national policy framework for Korea’s water supply system. A governmental authority, the Korea Water Resource Corporation (K-water), took a leading role in this program and oversaw 23 local waterworks. The average revenue water ratio (RWR), the proportion of billed water compared to the produced water provided into the distribution system, is the key measure for the efficiency of the water supply system. The effort succeeded: in the sample cases, RWR increased from 52.0 percent to 82.3 percent over 15 years, and an estimated total of 31,737 tons of treated water was saved annually (Kim 2018).

This effort worked in two main ways: (a) update old infrastructure and (b) equip the system with advanced technologies, including information and communications technology (ICT), which could enhance and improve both waterworks management and customer service.

Projects to enhance RWR cannot eliminate water leakage from the system because leakage control is costly and some degree of water leakage is inevitable. The appropriate level of loss is called the economic level of leakage (ELL) range, which minimizes the total cost from average real losses from the leak and active leakage control.

Development Challenge

In 2001, only 52.0 percent of water provided in the system reached consumers to be used and billed, because of old infrastructure and lack of appropriate management systems in Korea. Remote and rural areas were most heavily affected (Kim 2018). Low RWR reduced available water resources and revenue collection, and posed a risk of water contamination because of contact with the external environment and ground erosion.

Water loss in local waterworks facilities represented a critical challenge for the national water supply system for multiple reasons. First, given the shortage of water resources in Korea, maximizing the percentage of water that could reach the end user was crucial. Moreover, loss of water is directly linked to the loss of other resources, including energy. Second, water leakage represents a loss of revenue; although leaked water cannot be billed, the cost of its production and delivery is equivalent to that of billed water. Third, water leakage implies that water in the pipeline is in contact with the external environment, posing a
risk for reserve infiltration of pollutants, including sewage, which can cause health issues for end users. Fourth, leakage in the underground pipeline may undermine the ground, resulting in sinkholes and damages to other utilities.

**Intervention**

Waterworks RWR enhancement in Korea had two major components: (a) improving physical infrastructure and (b) embedding an ICT component in the water supply system. The central part of infrastructure improvement consisted of replacing the old facilities with new ones. ICT enhancement was implemented in most areas of the water supply system, targeting both operating organizations and end users.

Typical waterworks ICT for operators includes building a district metered area system by subdividing the network system into manageable discrete areas; detecting and restoring leaks; managing pipeline pressure; monitoring facility deterioration; implementing a GIS (Geographic Information System)–based pipeline network; implementing a telemetering and control (TM/TC) pipeline network operating system; and effects real-time data transition. Uses of ICT on the customer-facing side include real-time water quality monitoring and notification of abnormal water usage.

The providers and regulators of the water supply system were local governments. Many of these governments, however, were unfamiliar with up-to-date technology and operational knowledge, and lacked the necessary experience to take the leading role in RWR enhancement. In 2001, the Water Supply and Waterworks Installation Act, which governs water regulation, was revised to allow external organizations to manage waterworks by signing management contracts with local governments. The law designates local governments as the only legitimate water providers and also assigns them the role of regulator at the same time. However, the act enables the local governments to delegate water management service to eligible external organizations. The law lists eligible external organizations, and K-water is one of these organizations.

Because local governments were less familiar with the most up-to-date technology and operational knowledge, K-water took the leading role in the national efforts to improve the RWR and oversaw waterworks facilities through delegation contracts with local governments. Delegating waterworks management to K-water for the long term, averaging 20 to 30 years, was a major change in organizational structure and led to changes in the scope of work of the local government in basic infrastructure management.

**Addressing the Delivery Challenges**

RWR enhancement in Korea was a success overall, but implementation faced four major delivery challenges.

**Opposition and Lack of Consensus**

Disputes with a wide array of stakeholders represented the chief delivery challenge. A number of major stakeholders were opposed, for different reasons and to varying degrees, to the leading role played by K-water in the RWR enhancement program. Among the strongest opponents were local governments, the key stakeholders. They in some cases suspected that the management costs suggested by K-water were overestimated. Moreover, the political affiliation of the heads of local governments and local assembly members also complicated the dynamics, because they followed a partisan line, often overturning the decisions made by the precedent of the opposing party.

Public officers working for the waterworks management department in local governments and the Government Employees Union were concerned about potential job insecurity stemming from changes in the organizational structure for water management. Nongovernmental organizations (NGOs) opposed the delegation, arguing that this would amount to privatization of public services and prioritize company profit over public welfare, though K-water was a public enterprise.

Because of severe opposition, the initial project—a pilot in the city of Masan—was terminated. After finally agreeing on the delegation contract to launch the project in 2004, K-water relaunched another project in the city of Nonsan in 2004, followed by a project in the county of Jeong-up in 2005. Despite initial opposition from the local stakeholders, the
two projects were successes, seeing an increase in RWR of 26.5 percent and 31.5 percent, respectively, in just four years. K-water’s exemplary operation in these two cases mitigated many concerns of the stakeholders and helped K-water explain future projects better to the local governments and the public. These successful cases became widely known, thanks to media, and 10 additional municipalities joined the RWR enhancement project between 2006 and 2009. For civil workers who were affected by the management structure changes, local governments and K-water worked together to ensure job security and provide more favorable job conditions and privileges, including a salary increase.

**Lack of Standard Guidelines**

The lack of detailed guidelines in RWR enhancement was another challenge at launch. At the initial stage, the differences in the conception and expectations of RWR enhancement between stakeholders were significant. The main areas and scope of the projects were neither clearly set nor publicized. After launch, the procedures and technical factors to consider were also not explicit, creating confusions and unnecessary trial-and-error in implementation. The nature of the contract for waterworks management was another source of conflict deriving from lack of guidelines.

Reflecting these needs, the Ministry of Environment published the first guideline for the standard procedure in 2001, followed by a general manual in 2007 (Ministry of Environment 2001, 2007). K-water also published a detailed technical guidebook in 2009 (K-water 2009). The ministry and K-water continued to publish guidelines on the standard business process, including the standard estimation of consignment cost and the procedure for RWR enhancement. Several customized business models of the delegation were developed to meet the needs of the client.

**Limited Financial Capacity of Local Governments**

Third, the limited financial capacities of local governments impeded the enhancement of RWR. Although local governments were responsible for funding the water supply system operation and maintenance, many of the local governments, especially in rural areas, had insufficient funds to operate independently. Naturally, local governments were already heavily subsidized by the central government and were reluctant to launch large-scale infrastructure renewal projects such as the RWR enhancement.

The high training cost for technicians was another challenge. Adoption of the upgraded system meant that technicians needed to be retrained in the field, but this training cost raised eyebrows in local governments, where some officials and stakeholders were already uncomfortable with the infrastructure renewal cost.

In 2009, the central government proposed a subsidy for RWR enhancement up to 50 percent of the total budget, and the Ministry of the Interior and Safety included RWR as a local government performance monitoring indicator to encourage participation.

**Lessons Learned**

The following three factors were most crucial to achieving the success of the RWR enhancement project.

First, sharing successful cases of RWR with stakeholders was the first turning point for the RWR enhancement efforts. Because large-scale RWR enhancement efforts were unprecedented in Korea, not only the general public but the local government and other stakeholders were skeptical about the need for the project and whether it could actually be accomplished. They were also anxious about the cost and the changes it would bring to the community and the related personnel by delegating the service to K-water, as well as the political dynamics. However, after over a decade of the RWR enhancement, this program became a success story, backed up by high RWR and customer satisfaction numbers, and encouraged RWR enhancement in other regions.

Second, disputes were proactively settled and did not emerge. Soon after the project in the city of Masan was aborted, successful dispute settlement for the earliest cases of RWR enhancement in the city of Nonsan and the city of Yanjgu became benchmarks for settling disputes between different interest groups as implementation was scaled up. K-water actively shared and promoted the cases to explain its plan for action, the ways its plan would benefit various groups, and the ways concerns would be addressed.
Third, standardized guidelines and manuals were established, which covered a range of information, from technical aspects to management contracts and monitoring of the waterworks system. Both the Ministry of Environment and K-water separately developed guidelines, with the ministry devising both general and technical guidelines and K-water producing a highly technical document. These guidelines and manuals codified relevant procedures to give all stakeholders a clear picture of K-water’s RWR initiative, including detailed processes and procedures, technical standards, and contract conditions. The documents also enhanced policy effectiveness by helping to share expert knowledge and avoid “reinventing the wheel” or having to create solutions from scratch each time a new project was implemented.

References


