The Impacts of ICT on Waterworks Service Operations

Muneto Kawaguchi* and Hideaki Kuwada**

* Water Service Infrastructure Engineering Department, Waterworks System Division, PUC Co., Ltd. 6-5-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo, Japan
(kawaguch@puc.co.jp)
** System Service Department II, Public Solutions Division, PUC Co., Ltd. 6-5-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo, Japan
(kuwada@puc.co.jp)

Abstract
To ensure stable waterworks management, customer service operations must be conducted reliably. We must continue to improve our customer service operations, which consist mainly of collecting payments, to accommodate to the diversified environmental changes surrounding service operations. Making use of ICT (Information Communication Technology) is indispensable not only for conducting operations correctly and efficiently but also for improving operations.
We propose a general model of waterworks service operations based on our more than 40 years of experience and track record as an ICT specialist organization. In this model, customer service operations are conducted through the collaboration of three functional entities, namely call centers, service stations, and centralized operation centers.
As of FY 2013, the Tokyo Metropolitan Waterworks Bureau has three independent functional entities. Before FY 2004, each service station contained all three functional entities. In FY 2004, the call center was separated from the service stations, and later the centralized operation centers were separated from the service stations. ICT supports these shifts in water service management.
In this paper, while focusing on the changes in management styles of water service operations, we describe the above shifts in customer service computer operation systems and the possibilities of using ICT.

Keywords
payment collection system; ICT; service station; call center; centralized operation center; three-entity model

INTRODUCTION

As an ICT specialist organization, for more than 40 years PUC has supported the customer service operations of Tokyo, Japan's capital, which has one of the world's largest water-supplied populations as well as the highest levels of performance in terms of water supply coverage, leakage rate, and payment collection rate. In recent years, the TMWB (the Bureau of Waterworks of the Tokyo Metropolitan Government) commissioned us to run customer service operations as well.

We propose a general model of waterworks service operations based on our considerable many years of experience and track record. In our model, three functional entities (service stations, call centers, and centralized operation centers) work in collaboration to conduct customer service operations. Service stations accept applications and respond to inquiries over the counter from water users as well as read water meters; call centers accept applications and respond to inquiries from water users via telephone; and centralized operation centers conduct such service operations as calculating water charges, billing such charges, and collecting payments. We assume that waterworks service operations in all countries and regions may conform to this model, despite differences in the granularity (scope and scale of functions) of the functional entities.

As of FY 2013, the TMWB has three independent functional entities for conducting customer service operations. It has 34 service stations, 2 call centers, and 3 centralized operation centers.

Before FY 2004, each service station performed all three functions comprehensively within its own service area. In FY 2004, the call center was separated from the service stations in all Tokyo wards. Afterwards, the centralized operation centers were separated from the service stations in order to handle all operations related to collecting overdue water payments and accepting applications for account transfer payment as well as credit card payment.

ICT has supported these shifts in service operations management in the following way: the TMWB reconstructed its customer service computer operation system in 2002, before each functional entity was separated, by implementing an integration platform in order to systematically connect subsystems (Kuwada and Yamauchi, 2008). This integration platform includes a workflow system that passes tasks related to each service operation to staff in charge. Against this backdrop, when the call center was established as an independent entity, we linked a CTI system to the existing waterworks service operations system. Afterwards, we improved system functions to enable the centralized operation centers to be established as an independent entity. At the same time, with a view to supporting the independent management of these functional entities, we extended the workflow system so as to handle non-standard service operations among different entities as well as to share information among them.

It is important that the three functional entities be balanced well. The degree of independence, scope, and scale of functions of each entity should be able to flexibly be adjusted to meet various changes in the environment, though this depends on the circumstances surrounding each waterworks utility. Furthermore, for efficient management, it is essential to accommodate to advances in ICT.

MATERIALS AND METHODS

We developed our model in terms of functions and service entities. In our model, service stations, call centers, and centralized operation centers collaborate with each other to conduct waterworks service operations. In this section, we define the term waterworks service operations and the individual tasks that comprise waterworks service operations before studying the three functional entities that conduct waterworks service operations.

Definition of Waterworks Service Operations

The TMWB defines waterworks service operations as follows:

“Waterworks service operations” refer to all management operations regarding the use of water supply, including, above all, the collection of payments for water services. Considering the nature of tasks designed to ensure the collection of payments that support the water supply business and tasks performed based on water supply contracts with water users, waterworks service operations play crucial roles in water supply management. (TMWB, 2013)

Waterworks service operations can be classified into three major categories: operations related to water supply contracts; operations for the collection of payments for water services; and basic service operations such as information services for water users.

Definition of Tasks That Comprise Waterworks Service Operations

The tasks (water supply contract-related operations, water payment collection operations, and basic service operations) that constitute waterworks service operations are defined as follows.

Water Supply Contract-related Operations. When commencing or terminating use of water, customers must submit applications. Operations for accepting these applications constitute customer service operations.

Water Payment Collection Operations. Water payment collection operations refer to the sequence of operations from calculating water charges and billing such charges to customers through to collecting payments. Water charges are determined in accordance with the amount of water use, which is measured by reading water meters. Based on the measurement of water consumption and water supply contracts, water charges are determined and billed to water users. Receiving payments from users concludes the sequence of water payment collection operations.

Basic Service Operations. Basic service operations are operations that directly affect customer satisfaction. These operations are aimed at helping customers solve their problems by providing information in response to their inquiries, complaints, and requests. Basic service operations also fill the important role of improving water supply services through collection and analysis of data on customer needs.

Three-Entity Model of Waterworks Service Operations Management

We developed our model in terms of functions and service entities, as shown in Figure 1. In this model, waterworks service operations are conducted through the collaboration of three functional entities: service stations, call centers, and centralized operation centers. The level of independence and granularity of these entities varies depending on the environments facing individual water utilities. It is important that the three entities be balanced well in accordance with the environments of individual entities. In order to adapt waterworks service operations to changes in the environment, it is also important that the granularity of entities and the balance among them can be flexibly adjusted.

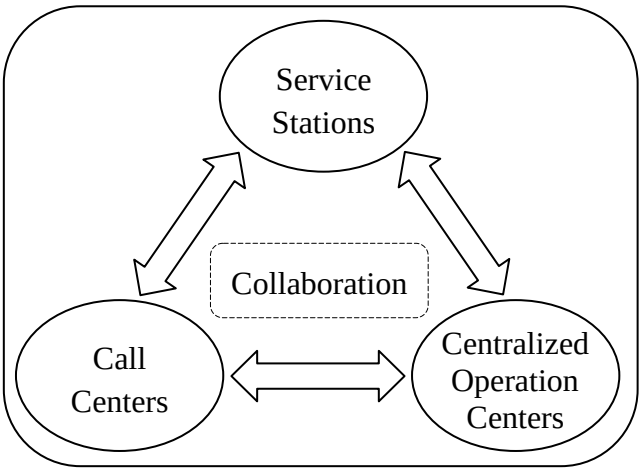

Figure 1
Three-Entity Model

Service stations, call centers, and centralized operation centers are defined as follows.

Service Stations. Service stations refer to functional entities deployed in different service areas that serve as customer contact points as well as local service sites. Specific functions as customer contact points include over-the-counter customer services, payment collection services, and basic service operations; functions as local service sites include operations that require fieldwork, such as reading water meters, urging customers in arrears to pay their bills, collecting overdue water payments, and quickly repairing water leaks.

Call Centers. Call centers refer to functional entities that are dedicated to providing customer services via telephone. One call center normally provides services for multiple service areas. Call centers have specific functions such as accepting applications, handling basic service operations, and providing contact services for water leaks and other emergencies.

Centralized Operation Centers. Centralized operation centers refer to functional entities that conduct operations that can be processed in a single location better than at the service stations or call centers that are distributed in each area. Functions performed by centralized operation centers include checking billing accounts and collecting overdue payments.

RESULTS AND DISCUSSION

Changes in Management Styles of Water Service Operations in Tokyo and the Contributions of ICT

In this section, we present the history of waterworks service operations management at the TMWB and the roles of ICT in different stages of development based on the three-entity model.

First Stage. Until 2004, service stations performed all three functions (service station, call center, and centralized operation center) within their respective service areas, as shown in Figure 2. In this form of service operations management, each service station provided services to all water users within the area under its jurisdiction. As the TMWB continued to provide this form of service for many years, it streamlined the core operations required for payment collection and other related operations (Kuwada, 2011) as shown in the following Chronology in order to improve operational efficiency as well as service quality.

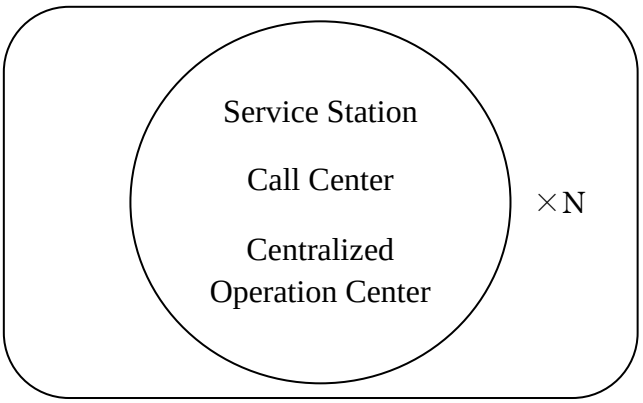

Figure 2
1st Stage of the Three-Entity Model

Chronology: History of the Management Styles of Water Service Operations and the Role of ICT in Tokyo

- October 1963
  - A computer system was introduced in the Tokyo Metropolitan Government Office.
  - It was expected that the computer system's high-speed processing of large amounts of data would support service operations, which continued to grow in number as the population increased.
- April 1964
  - The TMWB began to calculate water charges using the computer system. Batch processing by the large-scale computer enabled complex calculations of water charges to be performed accurately.
  - Recording media such as hard disks was hardly available. Handwritten data required for processing was entered into the computer using punch cards.
    Since computers were very expensive, precious resources installed in computer centers or other special locations, they were used only for calculating water charges and printing receipts and other reports.
- July 1972
  - A payment receiving system for automatic account transfer payment services started operation. This computer system enabled payments to automatically be checked against water bills. A direct debit system was also developed to automatically collect water payments from customers' financial accounts.

- At the time, Japanese financial institutions were developing online systems in order to improve their services. Particularly important is the fact that a system was developed in 1969 for automatic payment of public utility charges and for automatic deposit of salaries (Special Committee on History, Information Processing Society of Japan, 1998).

- December 1986
- An online water payment collection system started operation. This system enabled customer service operations to be conducted more efficiently than before. It had previously taken much time to search individual customer records, as a lot of customer records had been distributed in several books. This online system, which could store the customer records in the computer, enabled us to refer each customer record online.
- Online systems using ICT were developed in social infrastructure businesses, such as banking, electricity, and gas, to improve service quality and office work efficiency.

- March 1992
- A system for entering meter reading data directly into portable computers (handheld terminals) was put into operation. This system eliminated the need to enter handwritten meter reading data into a computer using a keyboard, thereby further increasing operational efficiency.
- Handheld terminals were first commercialized in 1973. "As their performance improved over time, handheld terminals were used by an increasing number of people in a wide range of business areas. In addition to EOS (electronic ordering systems), handheld terminals were used throughout Japan for a variety of purposes, including route sales, electricity, gas, and water meter reading, as well as public relations services for financial institutions" (Special Committee on History, Information Processing Society of Japan, 2010).

- January 2002
- The TMWB's water payment collection system, named SWAN, started operation. This online system could provide services 24 hours a day, 365 days a year, and it included a workflow system. One of SWAN's unique characteristics is that the system was developed based on a unified concept of a service operation integration platform (Kuwada and Yamauchi, 2008).
- The widespread use of PCs and the development of telecommunications technology during the 1990s made it possible to construct a workflow system designed to manage business processes using computers.

Second Stage. The TMWB separated the call center function from the first-stage three-entity model in 2005, as shown in Figure 3. In 2006, another call center was opened.

We receive almost all service start and stop requests as well as inquiries via telephone. In order to streamline service operations, the TMWB reorganized the management style it applied to water service operations so that call centers could manage and provide customer services in a unified manner, which previously had been the responsibility of individual service stations. As a result, service station operations were streamlined, enabling service station staff

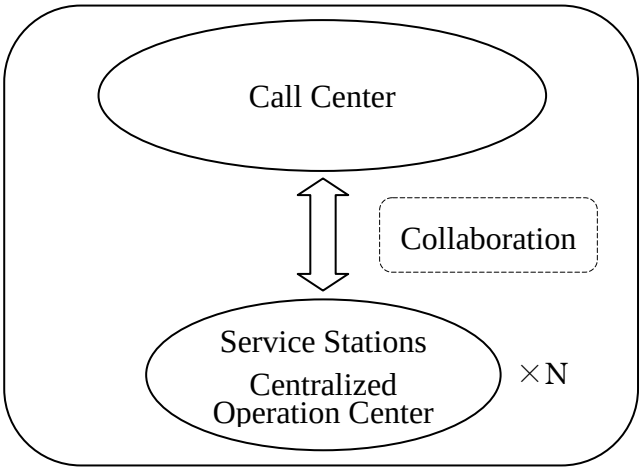

Figure 3
One of 2nd Stages of the Three-Entity Model

to focus on those operations that required difficult decisions.

We could not have established our call centers without the development of CTI. CTI is an acronym for Computer Telephony Integration, which broadly refers to functions that control telephone operations using computer software as well as related functions. Such functions include the following: a function for distributing incoming phone calls to relevant service staff members; a function for automatically sending calls to phone numbers designated in advance; a function for automatically returning voice messages to incoming phone calls; and a function for recording phone conversations.

The TMWB's payment collection system is linked seamlessly to this CTI system.

There are various stages of linkage between the payment collection system and the CTI system. In the first stage, the simplest of all, we can use the systems separately, each entirely independent of the other. In this case, however, the need to use two systems separately is likely to cause delays in responding to customers, thereby reducing efficiency in call center management. In the next stage, we can link the two systems through data transfer only. This stage of linkage is available in environments that allow for the installation of both systems on a single PC. Data can also be transferred by telephone operators using copy-and-paste, a standard OS feature. It is also possible to construct a system for transferring data between the two systems.

The TMWB has achieved an even higher stage in which the payment collection system and the CTI system are seamlessly linked. At this level, the two systems share not only data but also system features. For example, upon receiving a phone call from a water user, the CTI system hands over the users' phone number to the payment collection system and also retrieves information required to identify the user. This seamless linkage was made possible by a unified integration platform, which provided the foundation for coordinating the payment collection system and the CTI system.

Third Stage. In 2009, the TMWB separated centralized operation center functions (those regarding overdue payments) from the second-stage three-entity model, as shown in Figure 4. In order to improve the efficiency of service operations, the TMWB reorganized the management style it applied to water service operations so that a single center (functional entity) could focus on the operations required to research cases in which the use of water service could not be confirmed (unreported cancellations (JWWA, 2011)). Now, the centralized operation center and the service stations conduct the operations related to collecting overdue payments in collaboration. The centralized operation center handles overdue payments resulting from unreported cancellations, and the service stations conducts overdue payments resulting from the other reasons. Such operations had previously been handled by individual service stations.

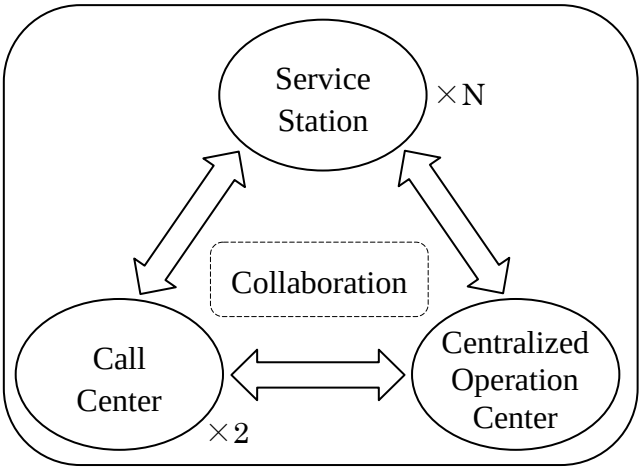

Figure 4
3rd Stage of the Three-Entity Model

When urging customers in arrears to pay their bills, we generally use the telephone to research customers' addresses and to issue notices. To this end, the CTI features used at the call centers were

also made available at the centralized operation center.

Other Possibilities for Developing Stages of the Three-Entity Model

We have described the changes in the management styles of the TMWB's service operations. However, there may be other possibilities for developing the three-entity model. Also, the granularity of the functional entities during each stage is not always the same; granularity varies depending on the environments facing individual water utilities. Here, we describe a variation in the second stage and variations in the granularity of functional entities other than those of the TMWB.

Variation in the Second Stage. Figure 5 shows another management style in which centralized operation center functions are separated in the second stage of the three-entity model.

If the TMWB had separated service operations for collecting overdue payments from the first-stage model before separating call center functions, its organization would have assumed this form.

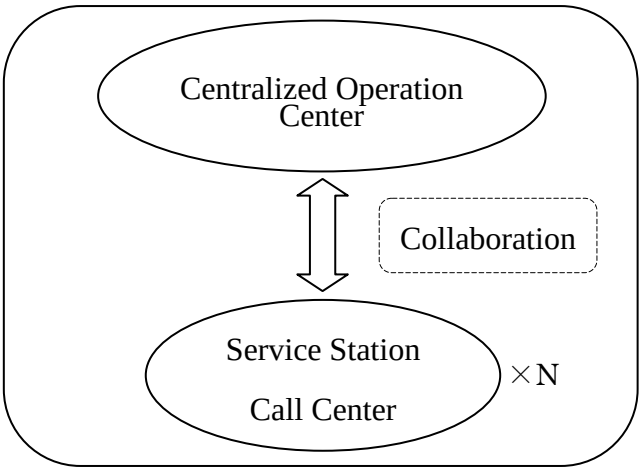

Figure 5
One of 2nd Stages of the Three-Entity Model

Variations in the Granularity of the Functional Entities. Figure 6 shows the general form of our three-entity model. As we have seen regarding the changes in management styles of water service operations in Tokyo and the aforementioned variation in the second stage, the level of granularity of the functional entities is not always the same; granularity varies depending on water utilities' environments.

In fact, the TMWB is working to improve its centralized operation center functions with a view to further increasing service operation efficiency. As a result, this will reduce the current functions of service stations and call centers.

In all of these cases, water service operations are conducted through collaboration of the three functional entities in our three-entity model.

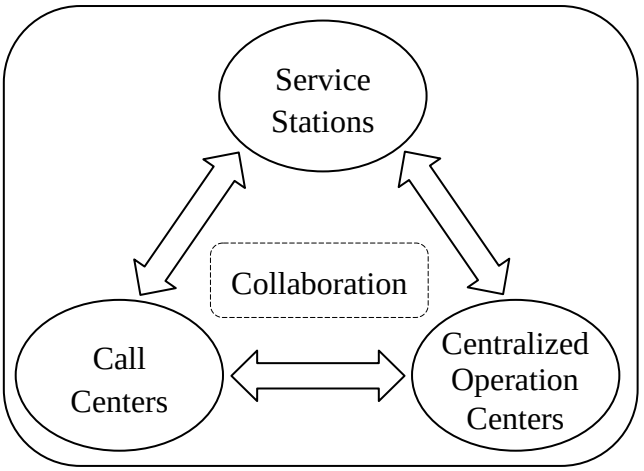

Figure 6
3rd Stage of the Three-Entity Model

Possibilities of ICT.

The process of evolution of water utilities and the granularity of functional entities vary depending on the environments facing each individual organization. Therefore, we cannot make sweeping generalizations about the use of ICT. However, there is no doubt that ICT has supported the development of service operations management at the TMWB. Its successful history leads us to conclude that if effectively used in accordance with the process of evolution of water utilities and the granularity of each functional entity, ICT has not only significant effects on but also great potential for management of waterworks service operations.

CONCLUSIONS

In this paper, focusing on changes in the management styles of water service operations, we have discussed changes in customer service computer operation systems. The granularity of the functional entities in the three-entity model that we proposed herein varies in order to provide optimal solutions depending on the environments facing water utilities. In all stages of the three-entity model, ICT plays important roles in improving service quality and productivity.

We believe the shifts in the three-entity model and the impacts of ICT in Tokyo are illustrative of global best practices. We would be happy if this paper helps in the development of waterworks in various countries and regions.

REFERENCES

JWWA. 2011 Water Service Operations Manual (in Japanese). Japan Water Works Association.

Kuwada H. 2011. From a Conventional Waterworks Service Operation System to a Widely Integrated System. Collection of Lectures Delivered at the 5th IWA ASPIRE Conference.

Kuwada H. and Yamauchi Y. 2008. Needs and Future Challenges in Installing an Integrated Business Processing Infrastructure on a Client PC (in Japanese). Collection of Lectures Delivered at the 59th National Waterworks Conference, pp. 40–41.

Special Committee on History, Information Processing Society of Japan. 1998. Evolution of Japanese Computer Industry (in Japanese). Tokyo: Ohmsha.

Special Committee on History, Information Processing Society of Japan. 2010. The History of Japanese Computers (in Japanese). Tokyo: Ohmsha.

TMWB. 2013 Service Operations Manual (in Japanese). Bureau of Waterworks, Tokyo Metropolitan Government.