

Administrative Reform for Sustainable Public Water Services in Japan: A Case Study of Sewerage Management Reform

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Abstract

The momentum of public water administrative reform intensified in Japan after the experience of the world financial crisis of 2007-2008, as well as the Great East Japan Earthquake and Tsunami event. The public water business reform in Japan continues to exhibit the organizational reform of corporatization and private sector partnership for more efficiency, but it does not show the institutional and resource governance reform examining a new division of roles between the national and local government and citizen participation in the water service policy development process. The “redundancy” of management resources coping with earthquakes and heavy rains is emphasized. Such redundancy of the sewerage service system is a cost-up and uncertain factor in long-term management risk, which is especially highlighted in the process of implementation of public-to-private outsourcing contracts.

Introduction

Water is an indispensable resource for humans; it is necessary to maintain a livable and healthy environment. Water services need to be developed with an emphasis on public interest from a long-term perspective (Koppenjan & Enserink, 2009). Historical experience shows that there are, at least, three models of water provision in practice, namely, the public model, the private model, and the community model. The public model is dominant in water services, but privatization and public-private partnerships (PPPs) were introduced to increase efficiency. Yet, it had become clear that some water privatization initiatives failed to extend water supply to poor households. Following this, the concept of community also came to play a greater role in the debate about alternatives to private sector participation in the water supply, particularly with respect to urban areas (Bakker, 2008). Especially, monopolistic tendencies in the water sector are the principal concern in privatization, as this may limit access to low-income citizens resulting in a lack of investment for improving water quality (Cesar, 2019).

Since the mid-1980s, liberalization has motivated numerous water supply reforms (see Table 1). This Bakker model of typology is useful because it enables us to correctly compare different types of administrative reforms, to more accurately characterize their goals, and to evaluate their outcomes. This typology is also useful in addressing the widespread failure to adequately distinguish among different elements of reform processes.

The privatization and commercialization/commodification of the water supply has been initiated in the processes of economic globalization (Bakker, 2003b, 2007; Swyngedouw, 2002). The process of aggregation and regionalization of water utilities

Table 1. Resource Management Reforms: Examples from the Water Sector

<i>Category</i>	<i>Target of Reform</i>	<i>Type of Reform</i>	<i>Example drawn from the water sector</i>
Resource management institutions	Property rights	Privatization	Sale of water supply infrastructure to private sector
	Regulatory frameworks	Deregulation	Cessation of direct state oversight of water quality mechanisms
Resource management organizations	Asset management	Private sector partnerships	Municipal outsourcing of water supply system management to private companies
	Organizational structure	Corporatization	From local government department to publicly owned corporation
Resource governance	Resource allocation	Marketization	Introduction of a water market
	Performance incentives/sanctions	Commercialization	Introduction of commercial principles (e.g., full cost recovery) in water management
	User participation	Devolution or decentralization	Devolving water quality monitoring to lower orders of government or individual water users

Source: Adapted from Bakker (2007: 435), Table 1.

usually offers the potential to realize economies of scale by increasing the size and efficiency of new investments; this is done by sharing infrastructure projects and accessing international funding (Frone, 2008). Differences in national traditions of public intervention, institutional arrangements, and public service markets make local public services an area of great diversity. For example, the United States finds that lower and less stable privatization from adherence to public choice emphasizes the benefits of market competition over public monopoly. In contrast, Spanish municipalities create hybrid public/private firms that benefit from both market engagement and economies of scale available under monopoly production (Warner & Bel, 2008).

At the level of municipalities, they have been compelled to make tradeoffs between environmental and social sustainability and economic sustainability. Finding creative ways to support utilities while circumventing their contradictions is required in terms of regulations, service delivery models, and municipalities (Furlong, 2012; Furlong & Bakker, 2010).

Private-sector participation in the financing construction and management of water infrastructure has increased significantly over the past decade (Bakker, 2003a). However, under inefficient PPPs, firms attempt to support the government by threatening to withdraw service in exchange for higher rents. Relative to traditional procurement, PPPs are complex, requiring institutional capacity to design tenders and contracts, conduct monitoring, and enforce contracts over the long term (Bloomfield, 2006; Iossa, 2018; Trebilcock & Rosenstock, 2015). From this perspective, ownership does matter when contracts are

incomplete. The owner has “residual control rights” and can make all the decisions concerning the asset that are not included in an initial contract (Hart, 2003). Furthermore, PPPs are widely and increasingly employed in the water sector in Asia, and here, the increasingly important role of mixed public and private company ownership is seen (Jensen, 2017). Entrepreneurship in contemporary public enterprises should also be explored (Tremml, 2019).

In Japan, deregulation and privatization of utilities have expanded in the field of railways, telecommunications, and postal services in the last 30 years. Public water business has been in a special position, as it has been managed in the form of a “local public enterprise,” in which it is part of the local government but corporate accounting has been introduced to ensure management efficiency, and the financing system has been implemented by issuing corporate bonds. All these measures have been put in place as a system for the efficient operation of highly public water and sewage business (Ministry of Internal Affairs and Communications. [n.d.]. Retrieved from http://www.soumu.go.jp/main_sosiki/c-zaisei/gaiyou.html.) However, tax revenues are decreasing, while spending on the welfare sector is increasing due to the declining birthrate and aging of the population; consequently, the finances of local governments are tight, and the large amount of debt outstanding related to the water and sewage business represents a future management risk of public organizations (Ministry of Internal Affairs and Communications, 2014).

This study aims to describe and analyze how the water service in Japan, a highly public business, has responded to social changes in the business environment. To properly operate water services, it is necessary to have a balance between publicity and efficiency because water and sewerage services are indispensable for public health. Therefore, this study examines the reform of the sewerage business in Japan based on the Resource Management Reform classification model proposed by Bakker (2007). Regarding the study of management reforms in the water business using this model, until now, there has been some analysis of cases in Europe and North America, but no analysis of Japan specifically or Asia in general. This study fills this gap. Conducting a case study with this model, clarifies the characteristics of Japan’s water business reform and introduce policy implications for the contributing public water business reforms and regional water management. The remainder of the paper presents the research methodology and analysis, followed by a discussion of the results and conclusion.

Research Methods

The methods of research included analyzing the text of policy materials and plans issued by the national and local governments and conducting interviews with the newly established municipality-owned sewerage operation entity in the Osaka City Government (OCG). The reason for taking OCG as a case study is that it is the second largest population center in Japan, with approximately 2.7 million people. It is one of the oldest cities in Japan that has developed a sewer system, and it is implementing organizational reform of the sewerage business ahead of other cities. In addition, here, we focus on sewerage among the water services. Water supply business has an exclusivity wherein the user’s

benefit can be easily grasped by measuring the amount of water compensated for; however, the sewerage business has the public purpose of excluding rainwater drainage; this is important because it is more difficult to identify the benefit for each user related to rainwater drainage than it is for water supply. In terms of providing public goods, sewerage service for rainwater drainage is a more public exercise than that for the water supply

Results of the Case Study

Japanese Sewerage System Outlook

This section reviews the policies and institutions related to the public sewerage business in Japan to understand the background of the case study. The Sewerage Law, which provides the legal framework of the sewerage business in Japan, was issued in 1958. The law rules on the sewerage comprehensive plans by river basin and sets the standards of management of public sewerage utility, thereby contributing to public health, urban development, the improvement of sanitation, and the preservation of water quality along public water areas. The national government sets the sewerage investment plan for each basin in the country. The national sewerage investment plan comprises the following: (1) basic policy concerning the investment in sewerage; (2) area covered by sewerage; (3) The location, structure, performance, and priority of investment in sewerage facilities; and (4) the quality of water (biochemical oxygen demand [BOD], hydrogen ions, etc.) discharged from wastewater treatment plants.

The local government runs the sewerage business and settles on the administrative project plans of sewerage facilities. It decides on the service level of sewerage business, investment, and budget draft. The sewerage fee is determined by the ordinance of the local government, with the approval of the assembly of the local government. According to Article 3 of the Sewage Law, the installation, rebuilding, mending, maintenance, and other management of sewerage is overseen solely by the local government (city and town government). If two or more cities and towns have the benefit of jointly installing the sewerage system, the prefectural government runs it for them. The national government coordinates the sewerage investment of the whole country and subsidizes the municipal sewerage business, so the local government submits the business scheme to the national government and obtains authorization (Sewerage Law, Act No. 79,1950). [Retrieved from https://elaws.e-gov.go.jp/search/elawsSearch/elaws_search/lsg0500/detail?lawId=333AC0000000079.

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sewerage business, so the local government submits the business scheme to the national government and obtains authorization.

The size of sewerage business in Japan varies, as it covers both metropolitan cities of over one million people and small towns with thousands of residents. Most sewerage businesses in Japan cover populations smaller than 30,000 people, and the population size is the same as the number of users of the service. The number of units is slightly decreasing because of the mergers of local governments, and such mergers are promoted by the national government for pursuing efficient local governance.

Table 2. Number of Public Sewerage Businesses by Size

Size of Population	Prefecture or designated cities	More than 300,000	100,000 to 300,000	50,000 to 100,000	30,000 to 50,000	10,000 to 30,000	Less than 10,000	Other	Total
Number of units	21	35	133	161	124	357	344	14	1,189
%	1.8	2.9	11.2	13.5	10.4	30.0	28.9	1.2	100.0

Source: Sewerage Business Management Research Strategy (2018: 9).

Public Sewerage Service System Reform in Japan (National level)

After the experience of the world financial crisis of 2007–2008 and the Great East Japan Earthquake and Tsunami, with the 2011 revision of the Act on the Promotion of Maintenance of Public Facilities by Utilization of Private Companies (PFI Act), originally enacted in 1999, the operation rights system for public facilities was installed. This was done to set a right to operate a public facility and receive fees as business considerations.

The Ministry of Land, Infrastructure, Transport and Tourism established the *New Sewerage Vision* in July 2014, aiming at the evolution of the sewer, including the adoption of new technology and optimization of sewage treatment. The vision indicates the direction for integrated management of administrative officers, facilities, and finance, and it is necessary to promote asset management and crisis management in the event of a large-scale disaster.

In response to the occurrence of approximately 4,000 road collapses annually due to sewer corrosion, the Sewerage Law was revised in May 2015 for the promotion of the maintenance and refurbishing of sewerage facilities via PPP. The special council system was established to promote wide-area and joint-development sewerage business across the municipal jurisdiction.

In August 2017, the *New Sewerage Vision Acceleration Strategy* was enacted. This is attracting attention in the sewerage sector, as well as PPP and PFI, including concessions. The idea of the strategy is to promote cooperation for sustainable administration of sewer business that utilizes know-how and inventive ideas from private enterprise. This vision comprises the six following elements:

1. Examining the most suitable sewage method according to the PPP;

2. Improvement of added value by the use of sewerage, such as wide area and efficient sludge utilization;
3. Preparing the most suitable facility scale and construction system for making use of the scale merit by employing the spare capacity of existing stock generated via the population decline;
4. Promoting the appropriate facility management by establishing a management cycle starting from maintenance and management;
5. Supporting water infrastructure export and global market expansion with the formation of effective projects; and
6. Promoting disaster prevention and mitigation, such as minimizing damage and achieving prompt restoration to cope with concentrated and intensifying rainfall and expected large-scale earthquakes.

In August 2014, the Ministry of Internal Affairs and Communications provided guidelines on the management of local public enterprises. The following three steps have been delineated: First, it is necessary to examine the significance of the business conducted by public enterprises and the need for services. Second, if business continuity and provision of services are not required, the business should be promptly abolished. Third, even if it is judged that the business or service provision is necessary, the profitability should be examined, and methods like complete privatization or business transfer to a private company should be considered. In the guidelines, the Ministry of Internal Affairs and Communications requested local governments to formulate a *public enterprises business strategy* which is a medium- to long-term basic plan to continue operating business stably in the future (Ministry of Internal Affairs and Communications, 2014).

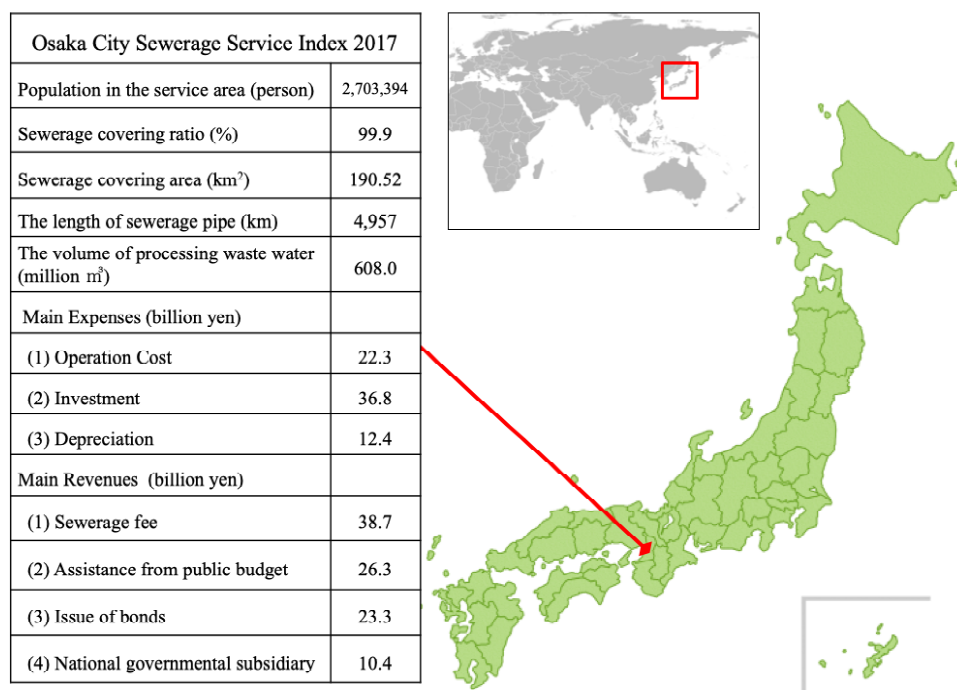
According to the Study Group on the Sewage Finance Interim Report: from December 2018, the following measures are now in the process of being implemented: (1) the promotion of regionalization and co-management; (2) future selection of efficient maintenance methods suitable for the area; (3) utilization of information and communication technology (ICT); (4) joint public procurement, such as several sewage treatment projects and projects of different fields across local authorities; (5) application of public enterprise accounting; and (6) anti-aging measures based on appropriate stock management.

The Case of the Osaka City Sewerage Business

This section confirms the progress of the sewerage business organizational reform by the OCG, adopting the “separation of infrastructure and operation,” which transfers the municipal operation management department of the sewerage business to an external organization. The OCG Public Works Bureau is in charge of sewerage service. According to the annual report of the OCG sewerage business account for fiscal year (FY) 2017, the city provides sewerage service to 2,703,394 people, representing 99.9 percent of its population. The city has a network of 4,957 kms of sewer pipe network, 58 pumping stations, 12 wastewater treatment plants, one sludge center for melting sludges produced during the treatment procedure, and a science museum to enhance the public understanding of the sewerage process. The sewerage business mission is to evacuate rainwater and provide sewage treatment services, developing the appropriate management and

investment of the sewage system as the important urban infrastructure, thereby contributing to the realization of safe and comfortable citizen life.

Figure 1
Location and Numbers of Osaka City Sewerage Business



Osaka City sewerage has three core businesses, as described below.

1. Antiflood business

In Osaka City, about 90 percent of the area is vulnerable to rain, and water pump evacuation is required. Therefore, the city is promoting the development of the sewerage system such that it does not flood once in 10 years, even in heavy rain (60 mm/hour). The city constructs the sewer network and pumping stations. The ratio of antiflood sewerage installed area for the total city area is 77.7 percent, while the capacity for evacuating stormwater is 1,319 m³ per second.

2. Improvement of the combined sewer system

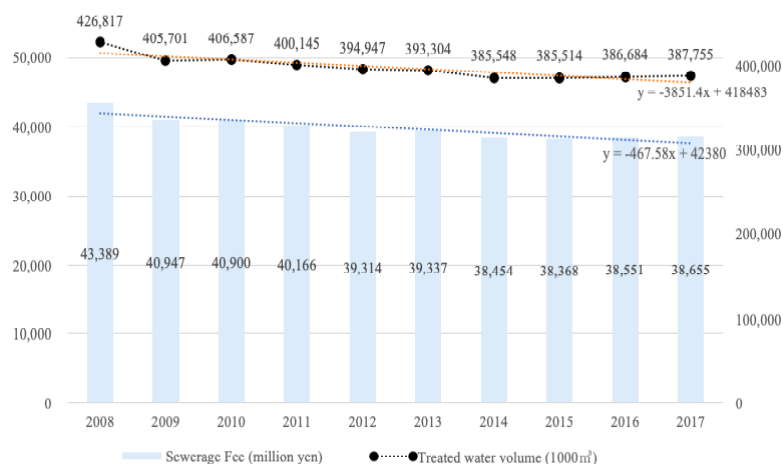
A combined sewer system is designed to collect rainwater and wastewater in the same pipe. It has the advantage of a low cost and short development period, but, if the rain exceeds a certain level of intensity, a part of the wastewater is discharged directly into rivers, causing water pollution. Therefore, the city constructs some ponds for storing dirty rainwater temporarily. The average inflow water quality (BOD) is 130 mg/L, and the average outflow water quality is 5.4 mg/L.

3. Renewal and refurbishment of aged facilities

In Osaka, the sewage system has been developed since 1894; in the 1940s, there was rapid development of the sewerage system, but, at present, many of these facilities are aging. Problems with these facilities may result in road collapse and downgrading of performance, thus, the city needs to renew and refurbish them regularly. In this case, it is necessary to engage in efficient resource- and energy-saving, anti-earthquake measures and maintenance improvement, establishing multipurpose use facilities, and fostering good relationships with local communities.

With the decline of the volume of treated wastewater, the sewerage fee revenue has tended to decrease by about one percent per year (see Figure 2). In contrast, as the necessary investment for the countermeasure project, first, the stormwater drainage capacity will be 90 percent in FY2025, up from 84.3 percent in 2013, and it will be 100 percent within 20 years. The estimated expenses necessary for this goal will be about 100 billion yen by 2025 and about 200 billion yen in 2026 or later. Second, the combined sewer improvement measures will require 100 billion yen. Third, renewing and refurbishing the old facilities requires 43.5 billion yen (see Table 3).

Figure 2
Transition of Sewerage Fees and Treated Water Volume
of Osaka's Sewerage Business



Source: Osaka City Sewerage Business Annual Reports (2017: 9).

Table 3. Expenses for Future Facility Maintenance in Osaka City Sewerage Business

<i>Core Business</i>	<i>Business Progress Target</i>	<i>Remaining Expenses</i>
Antiflood business	Protection from heavy rain (60 mm/hour) approximately once in about 10 years Rainwater drainage facility capacity (whole city average) of 84.3% to 90% (target in 2025), to achieve 100% in about 20 years	About 100 billion yen (until FY2025) To achieve 100% will require approximately 200 billion yen more
Improvement of the combined sewer system	Combined sewerage improvement rate of 51% to 100% (for FY2023)	Approximately 100 billion yen (until FY2023)
Renewal and refurbishment of aged facilities	Renovation and renewal of facilities requiring urgent care Focus on phased reconstruction and renewal Preventive maintenance	Annual investment of approximately 43.5 billion yen required in the future

Source: Adapted from the OCG Public Bureau (2015: 24)..

Organizational Reform of Osaka City Sewerage Business

The purpose of the organizational reform of Osaka's sewerage business consists of the following six points:

1. Maintaining high-level citizen services, securing high-quality technology and accumulating new know-how, and inheriting the skills and know-how of the staff engaged in the sewerage business;
2. Implementing project and business development through joint ventures with the private sector, which is difficult for public bodies;
3. Implementing water drainage and improvement of the combined sewer system with considerable time and cost for the purpose of securing citizens' safety;
4. Improving the efficiency of the business under an increasingly severe business environment due to the huge required renewal, despite the decreasing trend of water consumption (revenue);
5. Reviewing the number of maintenance department staff, since this is large compared with the staff sizes in other cities; and
6. Answering the demand for sewer engineers and technicians. In other cities, proper sewerage business management has become challenging because of a lack of workers trained in these jobs. This could be a business opportunity for Osaka, allowing utilization of the technology and experience in the city.

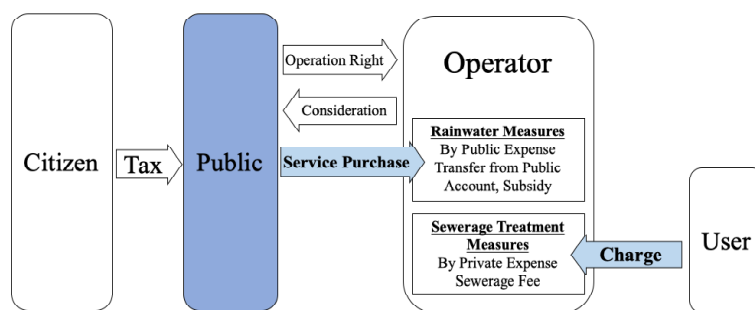
So far, operation and maintenance activities are comprehensively performed as a total system in the OCG, and there is no corporation that can take charge of all this business other than a newly established company. This has been done with the aims of continuously providing stable sewerage service to the citizens, guaranteeing the service level by inheriting knowledge and know-how from the present city governmental staff, and adopting a more effective procurement system with flexible long-term business contracts, receiving orders for operation and maintenance work from other cities. In this way, a new company was first established as an organization responsible for the comprehensive operation and management of sewerage facilities in Osaka City, but, this is not limited to being entrusted with the operations; instead, it can also conduct more efficient business management as a private enterprise. While aiming to conduct business, the company targets efficient business management that takes advantage of economies of scale by expanding the scope of business outside the region.

Management efficiency can be derived from the following four points: (1) a contract incorporating the private sector method; (2) adoption of the procurement method, efficiency of maintenance and management from the asset management perspective, and the reduction of power costs via the adoption of energy saving equipment; (3) the further implementation of the system by cooperation with private enterprise; and (4) the promotion of joint research and technology development by private sector collaboration. To acquire Osaka City's out-of-city operations, the company aims to achieve sales of 1 billion yen in 10 years in the operation and maintenance of sewers and treatment plants. As a profit target, the company aims to achieve a profit of around one percent of sales, including comprehensive outsourcing from OCG.

OCG aims to introduce a "mixed operation rights system" as the final organizational form of the sewerage business, due to the recognition that the city has been rationalizing operations so far and the effect has reached its limit. This system is a vertical separation system in which local governments own facilities and private companies carry out business operations and a part of capital investment, such as renewal of facilities financed by private companies' finances. For facilities throughout the city area, business is entrusted to outside organizations except for new construction, such as large-scale remodeling and reinvention, which requires a policy decision. The contract period is assumed to be 20–30 years. There is a high degree of freedom for the entrusted company in management from operation and maintenance to renewal, facility construction, financing, and overall business operation. Cost reduction effects are expected depending on the work level and target facilities. As Figure 3 shows, the owner of the operation right implements its business with the service purchase compensation (public expense) paid from the public sector and charges from service users (private expense).

For the expected schedule of this organizational transformation, before the introduction of this system, it will take about one year to coordinate with related organizations on the examination of financial schemes, such as subsidies and account transfers. Next, it will take about 18 months to implement the procedure based on the PFI method. Following this, it will take at least 3 years for the introduction of the operation rights system. Three steps are assumed for the transition of organizational reform (see Table 4). The first phase, phase 1, is comprehensive outsourcing, which will be carried

Figure 3
Model of a Mixed Operation Rights System



Source: Adapted from the OCG Public Works Bureau (2015: 57).

out on the operation and maintenance of the sewerage facilities by the existing Urban Technology Center, which is an affiliated association of the OCG. In phase 2, in addition to comprehensive outsourcing of operations and maintenance, small, simple renewal will be implemented by the newly established city-owned company. Finally, in phase 3, the mixed operation rights system will be introduced, and a range of renewals and refurbishments necessary for facility operation will be implemented.

Figure 4
Steps for Management Reform of Osaka's Public Sewerage Business

Business Area	Phase 1	Phase 2	Phase 3
Business Area A Public Administrative Specific Works	Public: Organized work related to Comprehensive business development Operations involving the exercise of public authority based on the Sewerage law		
Business Area B Construction	Public: New Construction for anti-flood, combined sewerage improvement Large-scale Update and Renovation works		
Business Area C Operation and Maintenance	Private: Comprehensive Outsourcing	Private: Comprehensive Outsourcing Small simple renewal works	Private: Mixed Operation Right System Contract term 20-30 years
Expected effects of Business operations	Reduction of maintenance costs		
	Revenue growth from domestic and overseas business development		
	Reduced construction costs		
Contracted Party	Affiliated general incorporated association	- New entity (Stock Company) 100% owned by City government	- Stock company - A part of the share is owned by private company

Source: OCG Public Works Bureau (2015: 67).

From the organizational perspective, the Sewerage and River Department of the Public Works Bureau is responsible for the planning of sewerage projects, design and maintenance of sewerage facilities, management of sewerage lands, coordination of water environment improvement and technologies, regulation of factory drainage, and research planning and management of river projects. In addition, four Area Administration Offices have been set up with responsibility for the implementation and maintenance of civil engineering facilities, such as roads, bridges, rivers, parks, and sewerage facilities. There were 2,849 Public Works Bureau staff members as of June 1, 2013, before the sewerage business reform; of these, 136 belonged to the Sewerage and River Department and 1,578 to the Area Administration Offices. In May 2018, the number of staff in the Sewerage and River Department had increased by 75, reaching 211, while the number in the Area Administrative Offices had decreased by 537, representing 1,041 employees. Through the reform of the sewerage business in Osaka City, the staff, who mainly operate and maintain the sewerage facilities at the Area Administration Offices, have been transferred to a newly established external organization, while the number of staff in the planning and management departments has been increased for strengthening their function of managing and monitoring the outsourced sewerage facility operations (Osaka City Government Construction Bureau, 2013, 2018).

The Process of Osaka City Sewerage Organization Reform

This section confirms the political decision-making process for organizational reform of the sewerage business in Osaka City. This reform process was first initiated at the Osaka Prefectural and City Integration Headquarters meeting in December 2011. In November 2012, as the Osaka City Sewerage Business Reform, the *Basic Policy and Implementation Plan* (draft) was announced, it introduced the “separation of infrastructure and operation,” which incorporates the principle of the private sector in the operation of the business. It divided sewerage service in the city into four areas and comprehensively outsourced operation and maintenance facilities to one of these areas from April 2013; after the results were reviewed, the solution was expanded to the whole city in 2014.

Because comprehensive outsourcing to the whole city was performed without problems in 2014, the *Osaka City Sewerage Business Organizational Reform Review Basic Policy* (draft) was announced in February 2015. Here, in addition to cost reductions, private management methods were incorporated via comprehensive outsourcing of operations and maintenance of the sewerage facility by a new municipally owned company from April 2016. It was shown that it could increase sales by receiving orders for operation and maintenance work from the alter city, eventually aiming for the introduction of public facilities in the mixed operation rights system.

For the Osaka City sewerage business budget in March 2016, the Osaka City Council stated that the city was responsible for the sewerage business, supervising it for protecting citizens’ safety and ensuring that it would be more efficient and sustainable for the future. Moreover, the council announced the five resolutions on the budget execution concerning the sewerage business organizational reform (Table 4). Thus, the Clearwater OSAKA Corporation was established on 1 July 2016 and started operations on 1 April 2017.

Table 4. Conditions of Osaka City Council for the Sewerage Business Organizational Reform Budget

Maintain current service level	As for outsourcing the sewerage business operation to the newly established company, the city will sufficiently supervise the company not only to make the management more efficient but also inherit the knowledge and technology possessed by the present staff.
Securing a crisis management response system	The city will make sure the safety and security of the citizens are maintained fully, considering crisis management, including disasters.
Cost reduction by the private management method	With the establishment of a stock company, it is necessary to consider the introduction of a more effective performance procurement system and take measures to reduce the burden on citizens.
Accountability and information disclosure	It is necessary to report the business plan to the City Council immediately after the establishment of the corporation.
Thorough consideration and accountability on promoting reform	The operating power system must be carefully examined, giving polite and sufficient explanations to Parliament.

Source: Retrieved from <https://www.city.osaka.lg.jp/shikai/page/0000349891.html>

Analysis of the Administrative Reforms Undertaken

Water service is highly public, and its operation should be pursued with the best mix of public, private, and community involvement. For pursuing public benefit and efficiency, the local governmental sewerage section has been managed with an independent accounting system and, as a local public enterprise, managed like the private sector for providing services organizationally, even in the local government. This system showed fruitful results from the rapid and efficient installation of a sewerage network in a comparatively short period. However, the economic slowdown, the huge accumulation of issued bonds, and the ongoing significant deterioration of the facilities have become a management risk for the local government. The integration of business units, outsourcing, PPP, and other business design improvements are essential for the sustainable management of the sewage system in the future.

As a result of this research, first, we showed that the momentum of the public water administrative reform increased in Japan after 2011 after the world financial crisis of 2007–2008 and the Great East Japan Earthquake and Tsunami. With the short-term factors of economic deterioration and disasters and the long-term trends of the declining birthrate and aging population, the reform momentum has increased in the public water services from the viewpoint of sustainable public administration.

The Japanese central government promotes the increasing business efficiency of municipal water business by integrating their business in the broader area and adopting PPP methods. From the classification for the resource management reforms in the water sector discussed by Bakker (2007), as illustrated in Figure 1, the public water business reform in Japan continues to exhibit the organizational reform of corporatization and private sector partnership as asset management for more efficient management. Yet, it does not show the institutional and resource governance reform of examining a new division of roles between the national and local governments.

In the scope of our research, there has been no eminent discussion about the charge for the rainwater portion of the sewerage business from the perspective of the full cost recovery in relation to commercialization reform. Furthermore, maintaining the present sewerage service level, which is relatively high compared with the levels of other Organisation for Economic Co-operation and Development (OECD) countries, represents an undisputed premise. Citizen participation in the water service policy development process has not been examined. In other words, the Japanese government has promoted the public water business reforms, focusing on the efficient asset management by private sector partnerships and little consideration of regional water autonomy.

Through the case study of the sewerage service organizational reform by the OCG, compared with the other international public water service reforms, we find that it is considered more important to secure a crisis management response and security in the event of a disaster, such as an earthquake or typhoon, than to focus on efficiency.

In Japan, special emphasis is placed on the function of the sewerage business to respond to heavy rain. A scheme where the full costs of sewerage services are borne by the beneficiaries, such as that introduced by the EU in 2000, is not applied in Japan. Rather, the costs of anti-flood treatment are covered by taxes. As is remarkable in the case of Osaka City, the operation of the sewerage network entrusted to a municipally-owned company is limited to small and simple renewal works of facility equipment. The new construction and management of large-scale sewers for anti-flood control will continue to require direct involvement by municipalities.

There are two issues regarding the determination of public sewerage service levels. The first is how much public sewerage facilities should be equipped to respond to disasters. The amount of sewage water treatment is stable throughout the year in proportion to the population and industrial accumulation; however, in the case of rainwater, seasonal fluctuations are obvious, and the uncertainty is increasing due to today's global climate changes. Recently, heavy rain—which is expected once every few decades—has been occurring almost every year. In addition, it is necessary to reinforce facilities that can respond to unpredictable large-scale earthquakes. To uphold the mandate of protecting the lives and property of the inhabitants, there is a need for the sewerage facilities to be able to cope infallibly with any heavy rains and earthquakes like those experienced so far.

The second issue is how to supply the necessary management resources to handle a temporary increase in business volume in the case of an emergency response if a disaster occurs. The implementation risk signifies that the subcontractor may not be able to perform the task in the event of an unexpected disaster. In that case, the question is whether a municipal government that is usually only performing monitoring activities and does not have a practical level of business operation know-how can substitute for the subcontractor in an emergency.

Due to the risk assessment of the issues, it is difficult for the municipal sewerage business to clearly define sewerage service levels, and the required service levels will continue to be extremely high. As pointed out by Bloomfield (2006), Iossa (2018), and Trebilcock and Rosenstock (2015), contracts can be extremely complex even when PPPs

are assumed under these conditions. The effort and cost required to design tenders and contracts and enforce contracts over the long term is significantly high. Therefore, as Hart (2003) described, it is expected that the municipalities will be able to mobilize the maximum resources in an emergency.

In the transfer of maintenance and management operations to the municipally-owned company, as in the Osaka City public sewerage business reform, the company is legally separate from the municipality; however, almost all executives are transferred from the municipality, and frequent coordination of the company's operations is conducted between the two parties. In effect, the company is under the asylum of the municipality and has such an affinity that it can be considered part of the municipal organization.

Since a municipally owned company will trust the municipality, they can agree even if there are ambiguous aspects in the details related to content and risks in the business contract. As seen in the case studies, this trust leads to a reduction in transaction costs in outsourcing the sewerage business. Unless such trust is established between the municipality and business trustee, the trustee company must create a detailed contract that assumes risks with a very high cost. Alternatively, they may prefer to reduce some of the risks through insurance schemes.

As in the Osaka City Council's debate on the sewerage organizational reform, issues that are predominant in the international water reform case, such as the discontinuation of services for low-income people and the lack of investment for improving water quality (Cesar, 2019), are rarely discussed. Regarding the disaster risk, it is important for the municipally-owned water corporation to build a disaster response system in accordance with the crisis management plan of the municipality, whereas a system design for bearing the stormwater exclusion cost is important for the procurement risk. Especially in Japan, after the Great East Japan Earthquake of March 2011, water and sewage facilities need to be resilient. Since then, a series of natural disasters, such as the Kumamoto earthquake in April 2016, have occurred, and the vulnerability of the water and sewage facilities at the time of the disaster is considered more problematic than it was before.

Conclusion

In conclusion, we describe the policy implications regarding further administrative changes of the public water services for the future. The capacity building to respond to disasters when outsourcing the management of highly public sewerage projects is one of the most important issues in the Osaka City Council discussion. The "redundancy" of management resources coping with earthquakes and heavy rains is emphasized. Here, "redundancy" means that: in preparation for the occurrence of a failure, the spare device is normally deployed and operated as a backup so that the function of the entire system can be maintained even after the failure. From a practical point of view, such redundancy of the sewerage service system is a cost-up and uncertain factor in long-term management risk, which is especially highlighted in the process of implementation of the public-to-private outsourcing contracts.

The sewerage business is a large-scale machinery and equipment industry, with many facilities buried in the ground. It is difficult to quantify how much repair and maintenance investment will be required to maintain the present sewerage service level, including the “redundancy” part, in the future, especially as the level of deterioration varies for each facility and machine; thus, uncertain variables of long-term sustainable management remain.

Concerning the Japanese public administrative recognition of accepting a public service monopoly and emphasizing disaster risk, at least in the short term, radical water service reform—including complete privatization—cannot be envisioned. It is imperative that ownership of facilities continue to be vested in the municipality. At this time, we have to watch the performance of the newly established publicly owned company closely, considering the challenges for the integration of wide-area operations by taking orders from outer jurisdictions, sharing management with the private sector, and actively introducing new technologies.

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Biosketch

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