Key Points
- Japanese experiences of implementing off-site and on-site sanitation and wastewater management (SWM) systems can give insights into sustainable financial mechanisms and institutional arrangements for SWM.
- There are referable steps that developing countries can follow according to the Japanese experience of implementing SWM systems for goals, laws and regulations, facilities, and the financial system.
- In many Asian countries, some patterns at the stakeholder level can cause systemic failure of the SWM system.
- An initiative for a well-organized SWM system is a way to achieve Sustainable Development Goal 6 by securing public health and providing a safe living environment to resolve SWM issues.

1. Introduction

Poor sanitation and wastewater management (SWM) in developing countries threatens people’s lives and well-being with water-related infections, expedites the transmission of diseases, and disturbs society with offensive odors and untreated wastewater. Moreover, the coronavirus disease (COVID-19) pandemic has emphasized the importance of access to safe and clean water. In line with Sustainable Development Goal 6, eradicating open defecation and adopting SWM systems ensures safe and clean water access.

Water contamination in households is due to open defecation and the discharging of untreated domestic wastewater. Open defecation has been identified as a primary reason for water contamination. Therefore, eliminating such behavior has been a priority for governments and international organizations. As a result, the World Health Organization (WHO 2022) reported that about 78% of the global population has access to toilet facilities. But the share of the population whose wastewater is treated safely—connected to an off-site system, released into an on-site treatment system, and disposed in situ or released into an on-site system where fecal sludge is emptied and transported to a treatment plant—remains only at 54% (WHO 2022).
In this policy brief, “sanitation coverage” refers to the percentage of the population whose fecal wastewater is managed safely; “wastewater management coverage” refers to the percentage of the population whose wastewater (both black and gray water) is treated safely. Human activities cause black and gray water. Black water refers to wastewater from toilets with human feces, while gray water is from kitchens, washing machines, and bathrooms.

The Japanese government has led projects to expand sewerage and decentralized SWM facilities. To successfully increase the installation of the facilities, the government enacted laws, stipulated financial schemes, and invested in developing technologies. In addition, it prepared various financial support programs for municipalities to conduct sewerage work. Thus, in Japan, sanitation coverage has been 100% since the 1960s to the 1970s; and wastewater management coverage, which refers to the share of the population covered with black and gray water management systems, reached over 90% in 2019. Considering the increasing number of SWM coverage in Japan, this policy brief provides ideas to the developing countries of Asia by taking a glimpse of the Japanese experience in SWM systems at the household level.

2. Major SWM Systems in Asian Countries

Providing SWM systems is a solution to secure access to safe and clean water for the present and future generations. Many developing countries have emphasized solving sanitation problems. As a result, total sanitation coverage has improved by installing on-site and off-site facilities (Figure 1).

Figure 1 shows that all eight countries have improved access to improved sanitation. The share of the population with access to improved sanitation—even if “limited” (meaning two or more households share the use of improved facilities) is also included—exceeds 75% in all eight countries. Nepal, India, Bangladesh, and Cambodia are the most improved countries in this regard. But the access to safely managed sanitation services lags. The share of the population with access to safely managed sanitation services is lower than 50% in three South Asian countries (India, Nepal, and Bangladesh). This rate is 60% (2020) in the Philippines. In Thailand, which had achieved almost-universal access to improved sanitation well before 2000, the access rate to safely managed sanitation remained as low as 25% in 2020. However, there is no JMP data on “safely managed services” in Viet Nam, Cambodia, and Indonesia. This may be due to the difficulties of collecting such data as desludging septic tanks in these countries.

The percentage of the population using the on-site system to manage sanitation is higher than the off-site systems in rural and urban areas. Nepal and India achieved high growth in on-site facilities compared with off-site systems; Bhutan installed off-site systems in urban areas about seven times more than in 2000 (JMP, open data). The distribution of off-site and on-site systems is similar in Nepal and India; the proportion of on-site facility use is higher than in off-site facilities in rural and urban areas.

The government compares the benefits and costs before investing in SWM systems. Decisions to install SWM systems are considered by weighing the benefits and costs. When determining costs, government and individual installers consider whether the expenses are one-time or recurring. Also, they evaluate whether the costs are fixed or variable. The benefits they consider by installing the systems are health, water, access time, reuse, and intangibles.

Poor SWM causes economic or income losses; per contra, the economic returns from operating SWM systems are potentially high. Eastern and Southeastern Asian countries have shown a higher sanitation coverage than other Asian regions. Cambodia's losses are estimated at $4.48 million per year, while the returns are more than $2 per dollar invested. Viet Nam's financial losses, including the health, water resources, and environmental sectors because of poor sanitation, are approximately 0.5% of its annual GDP. Indonesia lost more than $3.3 billion because of poor sanitation yearly. The Lao People's Democratic Republic's estimated financial loss is $193 million annually, and the returns are about $10 per dollar invested. The financial loss of the Philippines is about $1.4 billion, equivalent to per capita losses of $16.8 per year (ESCAP, 2015).

Given the annual economic losses caused by poor sanitation, encouraging people to install sanitation systems to treat black water is a priority for developing countries in Asia. Black water contains pollutant loads and pathogens that spread waterborne and water-related diseases, threatening people's workability. More than half of the total population of Asian countries lives in rural areas without full coverage of sanitation systems. Although a higher percentage of people in Asian urban areas have access to sanitation facilities, such as septic tanks, most facilities contain black water only. Thus, gray
Figure 1: On-site and Off-site Domestic Sanitation Systems in Asia (Selected Economies)
Source: Authors, based on data from the World Bank (open data) and JMP Ladder Chart (open data).
water, which contains a higher volume of pollutants, is discharged without treatment, polluting public water bodies and disturbing the residents’ pleasant lives. To encourage people to install facilities for managing wastewater, the government should consider the population density and the affordability of municipalities and households. The off-site facilities are suitable for high-density residential communities; the on-site facilities are more likely to be adopted in low-density residential areas. The quantity of wastewater is higher in high-density regions, and the system’s installation and operation are more affordable with robust financial conditions. Therefore, financial support systems and coordinating institutions for SWM management must encourage people to use the facilities.

3. Challenges in the Context of Sanitation and Wastewater Management Systems in Developing Countries

In developing countries, some patterns can cause the systemic failure of the SWM at the stakeholder level (Figure 2). The three important stakeholders involved in the said system are the local government, the service delivery operator (SDO), and the user.

First, local governments face weak policies and regulations, unclear gains, and insufficient funding. Clear policies and regulations are critical to meeting environmental and health standards and avoiding pollutants from on-site sanitation facilities. The government budget is the primary funding type for annual investment in the wastewater management system. Unfortunately, governments in developing countries also deal with depressed economies, political instability, and massive debt. Thus, they must prioritize other essential social services, such as health and education, over waste and sanitation.

Second, the SDO is not motivated and performs poorly due to lesser profits. Investing in the sanitation sector is negatively perceived because of lesser profits than in the other sectors, for example, energy or real estate. Most developing country governments in the region cannot deliver the required services, and the private sector is reluctant to invest due to the risks and low returns, especially for sanitation. Furthermore, installation and maintenance inspection costs are quite high, making it crucial to find a way to reduce maintenance inspection costs effectively.

Finally, users have a low willingness or affordability to pay for SWM services. The public’s willingness to use the SWM system is consistent with each household’s

Figure 2: The Systematic Failure of Sanitation and Wastewater Management System in Developing Countries

Source: Authors.
economic situation and awareness. People will not be willing to pay when the rates exceed what they can afford. In many cases, a threshold of unwillingness to pay is estimated by considering city population density and income disparity. If people are unaware of the need for SWM services, they may think the benefits are insignificant compared to the services' costs.

4. Learning from Financial Mechanism and Institutional Arrangement for Domestic Wastewater Management in Japan

In Japan, the major domestic wastewater management systems are sewerage and Johkasou. The sewerage system, the primary facility treating wastewater that nearly 80% of the people in Japan use, operates in urban areas. The proportion of people using sewerage services differs by city size; a city with more than 1 million people provides 100% of the service. While a city with less than 50,000 people generally adopts the Johkasou system to manage the wastewater from the households due to the small population size and inappropriate geographical features. Moreover, depending on the economic level, the threshold population covered with the off-site (sewerage system) or on-site (septic tanks, etc.) system differs. In countries like India, where sewerage systems are well introduced in urban centers, the sewerage coverage decreases dramatically as the city population is lower than 1 million.

In the background of the Japanese domestic wastewater systems, the enactment of the Sewerage Law and the Johkasou Law played a prominent role. The Sewerage Law, enacted in 1970, contains the roles of central and local governments; plans for formulating the projects, sewerage systems, and essential facilities; and criteria for effluent quality, structural standards, and financial schemes for providing procedures of national subsidies. The primary financial method for constructing sewerage systems comprises national funds, local government bonds, city planning tax, and beneficiary payment. The Johkasou Law enacted in 1983 specified its technology, operations, and management. The Ministry of the Environment financially supports the installation of Johkasou. To secure the basic standard for the population's healthy lives, the Japanese government subsidizes local governments or individuals for constructing SWM, and people for installing Johkasou at their site.

4.1 Sewerage System’s Financial Scheme for Construction

To foster sewerage construction and maintenance, the Sewerage Finance Research Committee was formed to establish the principles for sewerage system financing. The committee's first achievement was establishing the principle of stormwater at public burden and wastewater at private burden. Under this principle, the users of the sewerage system are to pay the operation and maintenance (O&M) cost for wastewater management as the sewer user charge. But the municipal general account will cover the O&M cost for rainwater management.

When a severe water pollution problem threatened public health and became a serious social problem in the late 1960s in Japan, the so-called “Pollution Diet” was convened. It enacted a series of laws related to the preservation of the environment, including the Water Pollution Control Act of 1970. In 1972, the committee pointed out that the country is responsible for developing sewerage systems. Therefore, the committee considers the provision of subsidy for sewerage construction appropriate. As a result, the cost-sharing principle, a basic scheme in fiscal principles of sewerage systems, was established based on the committee's recommendation.

The funds to construct the sewerage systems include national funds (subsidy), local government bonds, city planning taxes, and payments by service beneficiaries. Regarding fostering sewer systems, the central government is responsible for promoting sewer works from a country's standpoint. The local government is responsible for implementing sewerage projects. In the ratio of national subsidies vis-a-vis granted construction projects of sewerage facilities, the national subsidy takes half of the total cost, and the local government takes the remaining cost under the principle of cost-sharing ratio. The ministry conducts evaluations to ensure that the project's deliverables meet the conditions for granting national subsidies. The local government must return the received subsidy when the outcome does not meet the subsidy criteria. The cost borne by the local government is mobilized by issuing local government bonds, which are repaid with the user charge and the general account of the municipality.

Under the City Planning Law, the local government could ask for a part of the city planning project costs from the beneficiary, mainly landowners and houses in the city planning area. They get benefits, such as the rising price of the land, due to the construction of sewer pipes. Also,
the local government collects a tax as revenue for the city planning expenditure.

When local governments issue bonds, part of the repayment amount will be included in “standard financial needs,” a calculation of the central government’s tax allocation to local governments according to their financial needs. This local allocation tax system enables local governments to issue local government bonds to build essential infrastructures, such as sewerage systems.

4.2 Sewerage System’s Finance Scheme for O&M

The sewerage system’s O&M finance has expenditures, which are O&M costs, the municipality’s bond principal, and interest redemption. A national subsidy is not provided to maintain sewerage systems. Instead, the local government bears the O&M cost of stormwater drainage through its general account. While the users’ charge mainly covers the expenses for treating wastewater, public expenditures, such as taxes, help support the costs when the charge from the users is insufficient to cover the O&M costs.

4.3 On-site System Finance Scheme for Installation

The standard on-site systems of Japan named Johkasou have two different installation financial programs that the Ministry of Environment conducts. The programs are designed to provide national subsidies for Johkasou installation to individuals and municipalities.

The Johkasou installation program financially supports the installation costs of Johkasou by the household. Its finance scheme consists of national, prefectural, and individual expenses. In 1987, the ministry started the program to give one-third of the subsidy the prefectures and municipalities provided to the individual. The total amount of national, prefectural, and municipal subsidies to the individual is 40%, and the household pays the remaining costs. This amount of money, equivalent to 40%, is equivalent to the environmental benefits of treating non-fecal domestic wastewater (gray water). Please note that before the current Johkasou technology was developed for household use in the early 1980s, the old-type Johkasou, which treated only black water, was used widely. But it was not subsidized. Under the installation program, households are responsible for Johkasou’s O&M.

In the other program started in 1994, the Municipal Johkasou Installation Program, the ministry subsidizes one-third of the installation cost of Johkasou installed by the municipal government in private premises as a public works project. The municipalities pay two-thirds by issuing sewerage works bonds. Part of the bond issuance is subjected to local allocation tax measures. The municipalities take charge of Johkasou’s O&M, and the users pay the municipalities the O&M charge, which is the same as the sewerage user charge.

When a resident builds a new house in an area without a plan for a sewerage system in the near future, he or she is obligated, under the Johkasou Law (revised in 2001), to install a Johkasou to treat both black and gray water and discharging effluent to the environment. But the resident can continue to use the existing vault toilet or old-type Johkasou, which stores or treats black, but not gray, water if the resident has no plan to rebuild the house. As a result, the untreated gray water continues to pollute the drains, rivers, and lakes. This is a big concern for the government. Therefore, to promote the use of Johkasou and in addition to the two subsidy schemes mentioned above, the Government of Japan introduced additional subsidies for removing the old-type Johkasou (since 2006) and for installing in-house piping works associated with the conversion works from the old-type Johkasou to the new Johkasou (since 2019).

4.4 Economic Impact of Japan’s Sanitation and Wastewater Management Policy

Generally, constructing infrastructure is vital for governments for improving citizens’ quality of life and economic growth. It creates jobs and effective demand to overcome recession. However, government-led projects for construction infrastructures were inefficient. The paradigm of government-led projects changed into cooperating with private investment.

SWM policy supports people’s production and consumption activities. Under the Johkasou Act, the Government of Japan authorizes operators, such as maintenance vendors, desludging vendors, and designated inspection agencies, to maintain the Johkasou. Furthermore, the Act includes enforcement regulations stipulating the frequency of inspection according to the type and capacity of the Johkasou. The government creates the Johkasou industry through legislation—manufacturing, construction and installation, maintenance businesses, and employment.
5. Policy Makers Put Lessons from Japan into Practice

The Japanese experiences in managing the financial and institutional aspects of domestic SWM can be replicable in some developing countries. Figure 3 illustrates the referable steps in implementing domestic wastewater management systems.

Below are referable steps to follow, according to the Japanese experience of implementing domestic SWM systems:

1. The government should aim to expand the SWM system. In the 20th century, the Japanese government developed a plan to implement SWM systems to provide a clean environment for the people.
2. In the 1960s, a severe social issue arose due to the surplus of fecal sludge. The system that primarily managed the fecal sludge used to be the system for collecting fecal sludge and the Night Soil Treatment Facility. In the same period, the old-type Johkasou, which treats only black water, was widely used to cope with the demand for a flush toilet.
3. In the late 1960s, severe water pollution became another social issue. Together with industrial pollution, a lack of management system of gray water was a cause of water pollution. In the 1970s and afterward, the government aimed to expand the sewer systems and advanced Johkasou to control water quality.
4. After setting goals, laws and regulations were enacted to put the plan into practice. Japan was able to introduce the SWM system because it enacted legislation successfully. The Japanese government passed the Sewerage Act and Johkasou Act to specify the technical, legal, and managerial aspects of the off-site and on-site systems for successful installation and maintenance. Robust financial systems were also established.
5. The governments of developing Asian countries should identify suitable facilities for their countries and focus on investing the technology for those facilities. As explained in section 2 of this policy brief, many developing countries in Asia have adopted on-site sanitation systems in the past 2 decades. The Japanese government has put effort into developing the advanced technology of Johkasou as the on-site SWM system. Thus, unlike the old-type Johkasou, the new technology to treat black and gray water has been invented. The government is now encouraging people to convert the facility into a new one.
6. A financial system is required to operate and maintain SWM systems. Since the systems are not profitable, the government is the primary stakeholder in ensuring finances. Maintaining affordability allows users to continue the use of the facilities.

It is important to highlight that under different environmental conditions in developing countries are certain limitations in adapting Japanese experiences related to the technology, the country’s financial status, implementation area, and research and development. First, developing countries must increase the number of investments in developing technologies to manage

Figure 3: Steps for the Growth of Domestic Wastewater Management System

01 Plan
The organizations need to set up goals.

02 Laws & Regulations
Laws and regulations are required to achieve the plans.

03 Technologies
Identify suitable technologies for the country to comply with regulations.

04 Finance
Stabilized finance is essential for introducing the facilities.

Source: Authors.
all types of domestic wastewater. However, the gap in financial input for research-improving technology is a limit to adapting the Japanese experience in developing countries. Second, as local government funding is weak due to low density, and the affordability of the households differs according to their income, the various subsidy programs for the local governments and households in Japan will also be challenging for developing countries to adopt. Moreover, because of geographic features, such as hills and mountains where the supply chain is long, the price of the sanitation facilities must be high compared to the flatland (UNICEF 2020).

6. Conclusion

The fact that many Asian countries put a global burden on poor sanitation and poor water quality, which threaten public health, urges the need for infrastructure investment. Over the past 2 decades, the number of people in developing countries in Asia has increased using SWM systems, particularly on-site systems. However, there are still demands for improvement in sanitation coverage. The leading cause of poor water quality was open defecation and improper management of on-site sanitation systems. The governments put efforts into overcoming such a situation and made remarkable progress. A distinctive feature of the achievement is that the on-site sanitation facilities are installed in rural and urban areas.

Identifying the problems and mapping the causes are vital for policy makers to foster the expansion of SWM facilities. The obstacles hindering further improvements at the stakeholder level, specifically local governments, SDOs, and users, are related to weak financial states. To promote the installation of the facility, the government should have a system based on the rule of law that regulates the role of stakeholders, the quality of SWM, and the financial plans. According to the Japanese experience, the Sewerage Act and the Johkasou Act established the basis for improving SWM coverage with financial schemes and institutional arrangements.

Policy makers can follow the recommended six steps to have an SWM system. In applying the steps, challenges may appear due to different cultural or environmental backgrounds. Nevertheless, the achievement of such a system that manages all types of sanitation and wastewater is worth pursuing for the country’s development in terms of economy, environment, and public health, with no one left behind.
References


