

### Key Points

- Despite improvements in access to improved sanitation facilities, improper decentralized wastewater management still causes water pollution.
- The majority of septic tanks are improperly installed, and the “on-demand” desludging system is proving inefficient.
- Japan has successfully implemented an effective and robust institutional framework to test and approve new technologies as well as ensure the proper installation of decentralized wastewater treatment facilities.
- The experiences of Japan, Malaysia, and Indonesia show that mandatory desludging is effective. The case of Dumaguete in the Philippines demonstrates that highlighting the benefits of an efficiently working sanitation value chain can improve willingness to pay.
- Systematic training for desludging workers can help regulate them, cultivate their professionalism, and raise their social position.

# Institutional Mechanisms for Sustainable Sanitation: Learning from Successful Case Studies

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Even though access to improved sanitation facilities has improved, progress in access to safely managed sanitation services is still slow. Globally, 4.5 billion people still lack access to safely managed sanitation (UNICEF and WHO 2017). Such inappropriate management of excreta is a main source of pollution of public water bodies, rivers, canals, and ponds, particularly in the urban areas of many Asian developing countries. According to a survey conducted by the Japan International Cooperation Agency (2012), in Jakarta, Indonesia, although the share of residents with access to improved sanitation facilities has reached 87% (85% to septic tanks and 2% to sewerage systems), the rivers in the city are seriously polluted.

One of the causes of water pollution may be attributed to improper decentralized wastewater management. According to the United Nations Children’s Fund and the World Health Organization (2017), about half the global population is using non-sewered sanitation—and its poor management is among the leading causes of water pollution. To discuss the innovative ideas on accelerating the progress on safely managed sanitation through citywide inclusive sanitation and fecal sludge management, the Asian Development Bank Institute (ADBI) hosted the Development Partner Roundtable and Policy Dialogue Session on Sustainable Sanitation in Asia on 20–22 September 2018. More than 40 participants attended, including 25 officials from various development organizations and 9 government officials from Asian countries. Based on the discussions at the event, this policy brief draws out lessons and recommendations for institutional arrangements for sustainable sanitation.

## The Challenge

The majority of urban residents in Asian developing countries are using septic tanks, many of which are improperly installed and sometimes inaccessible for desludging. Septic tanks often do not conform to the desired quality parameters, and many



are designed only to handle black water (wastewater from toilets containing pathogens) and not gray water (wastewater from household use other than toilets). The prevalent “on-demand” desludging system often is incapable of improving the condition of water bodies because septic tanks can become inefficient in primary (or initial) treatment long before they are full and desludged. In addition, the efficiency of the desludging system is often poor due to factors such as unaffordable desludging fees, poor quality of desludging services by the unregulated desludging operators, and the illegal disposal of sludge at locations other than sludge treatment plants (STPs) (caused by distance or sludge disposal fees at the plant, etc.). Moreover, the development of STPs is far behind that of sewerage systems in developing countries, and the level of utilization of such plants is often poor due to the lack of a regular desludging system and the poor design of the STPs, among other factors.

In such a context, this policy brief explains how Japan’s decentralized wastewater management system, or packaged aerated wastewater treatment plant (PAWTP or *johkasou* in Japanese), evolved and how it works. The following are the key elements that are taken from the Japanese experience and relevant for wastewater management in developing countries:

- Establishment of a qualification, examination, and training system for installation vendors and/or workers of decentralized wastewater treatment facilities
- Introduction of a regular desludging system
- Establishment of a qualification and training system for desludging vendors and/or workers
- Establishment of a qualification, examination, and training system for maintenance vendors and/or operators of PAWTP or similar facilities for commercial buildings
- Strengthening of the inspection of PAWTP or similar facilities for commercial buildings

## Japan’s Decentralized Wastewater Management System

### *Evolution of the Non-Sewered Sanitation System in Japan*

Before 1945, vault toilets, which had a watertight structure and functioned as a temporary storage for “night soil” (fecal sludge), were the most popular style of toilets in Japan. Night soil was transported to rural

areas and used as fertilizer. In the 1950s and 1960s, however, the increasing amount of night soil from growing urban areas became a serious social problem; municipalities carried out the treatment of night soil, and the government promoted the development of advanced night soil treatment technologies. As a result, by the time the nationwide development of sewerage systems started in the mid-1970s, more than 1,100 night soil treatment facilities had been built across the country.

Beginning in the late 1950s, due to the country’s rapid economic growth, the demand for flush toilets became high. On the one hand, the lack of running water made it impossible to use the traditional vault toilets as flush toilets; on the other, developing the sewerage system and connecting households to it might have taken a long time. Hence, PAWTP technology was developed for use with flush toilets. In the 1970s, together with the sewerage system, PAWTPs became a prominent measure for the dissemination of flush toilets and the improvement of sanitation. At the time, PAWTPs treated only black water.

From the early 1980s onward, the pollution of public water bodies caused by gray water became highly visible. In 1983, the *Johkasou Act* (PAWTP Act) was enacted to overcome this situation. The passing of the PAWTP Act is worth mentioning in that the ministry in charge usually drafts such laws and presents them to parliament for voting. In the case of the PAWTP Act, however, since its contents affected multiple ministries and no single ministry took charge of drafting it, it was the parliamentarians who compiled the draft—with the support of the stakeholders of Japan’s decentralized wastewater management system, such as the PAWTP operation and maintenance (O&M) vendors and desludging operators. They supported the promulgation of the PAWTP Act since improving the country’s decentralized wastewater management system was vital for them to continue their business. The law clearly defined the legal basis for the installation of manufactured PAWTPs as well as their maintenance, inspection, and cleaning (desludging). To ensure these measures were translated into reality, the law further specified the responsibilities and duties of the PAWTP operators and established a state certification system. Accordingly, the state certification of PAWTP installation workers and maintenance operators was created. When the PAWTP Act was amended in 2000, the PAWTP definition eliminated the black water-only type, making it compulsory for all newly installed PAWTP facilities to treat both black water and gray water.

### Institutional Structure, Clear Responsibilities, and Efficient Compliance

The PAWTP Act delineates the roles and responsibilities of various stakeholders of the decentralized wastewater management system in Japan (see Figure 1). In addition to specifying the responsibilities and duties of PAWTP operators, the law also specifies those of users, the central government, municipalities, inspectors, desludging businesses, and training institutions. As mentioned, state certification systems for PAWTP operators, installation workers, and maintenance operators were created.

### Quality Design and Appropriate Installation of PAWTP Units

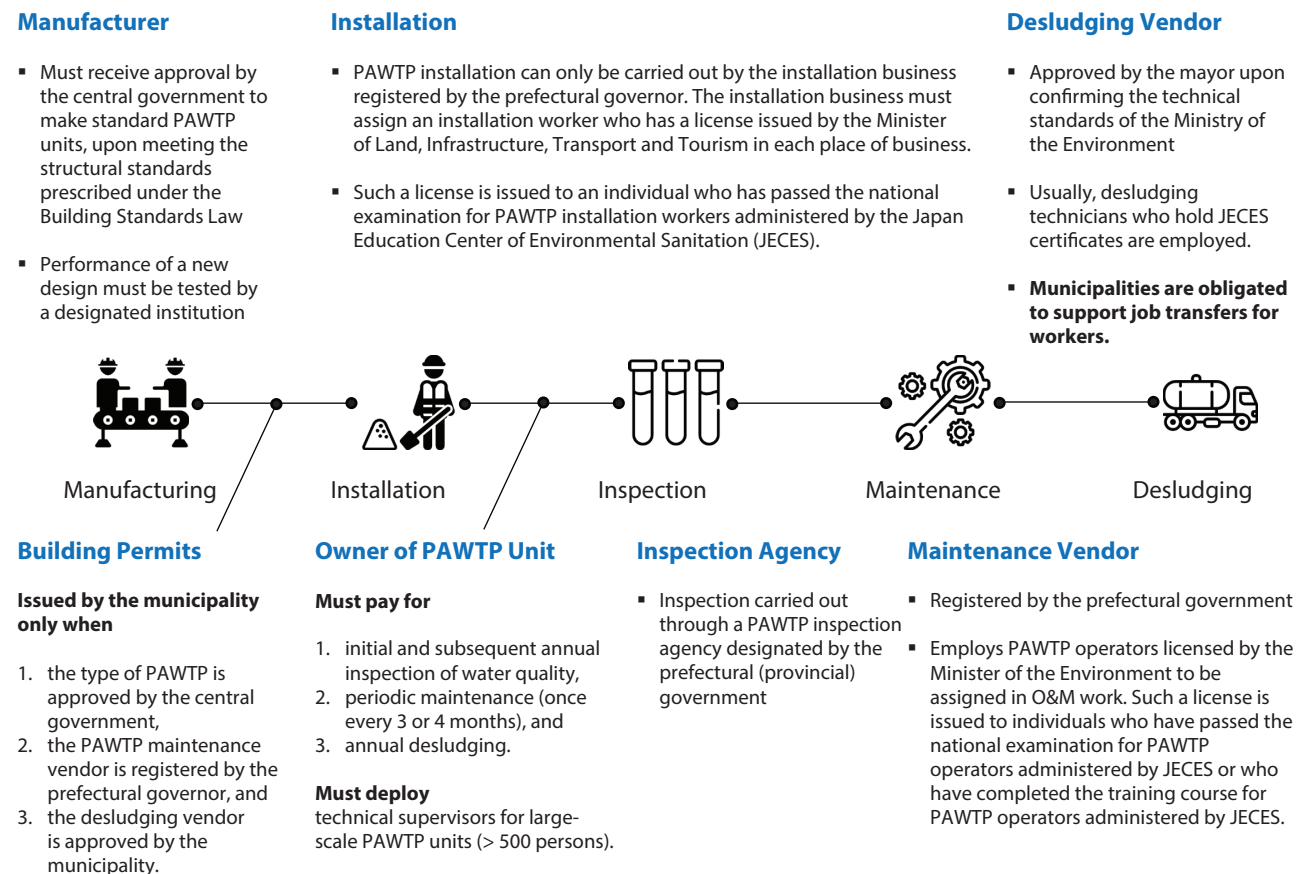
Japan ensures that its decentralized wastewater treatment plants are performing well through adequate quality control of the design and manufacturing process. A corporate body that intends to manufacture standard PAWTPs in a factory must receive approval issued by

the central government. Moreover, a designated testing institution tests any new type of PAWTP. The institutional arrangement also ensures that only adequately designed PAWTP systems are installed during construction. The municipality grants permission to build only when the proposed PAWTP to be used at a given site is preapproved.

The PAWTP Act also mandates the construction vendor (i) to be registered by the prefectural government; (ii) to employ at each business office installation workers who have been licensed (after completing a course or an examination) by the Japan Education Center of Environmental Sanitation (JECES), the designated examining agency; and (iii) to have the licensed installation workers conduct or supervise all PAWTP installation works. Consequently, only qualified workers engage in PAWTP installation works.

Such a robust institutional structure ensures that only quality wastewater treatment facilities are installed and done so properly, thus eliminating the deficiency in the

**Figure 1. Roles of Stakeholders in the 1983 Johkasou Act (PAWTP Act) in Japan**



O&M = operation and maintenance, PAWTP = packaged aerated wastewater treatment plant.

Source: Prepared by authors.

wastewater management system arising out of such considerations.

### *Regular Inspection and Efficient Operation and Maintenance of PAWTP Units*

The PAWTP Act mandates the PAWTP manager (owner of the household or the PAWTP unit) to accept the effluent water quality inspections by the PAWTP inspectors designated by the prefectural governor, once immediately after the installation of the plant and annually thereafter. Similarly, the PAWTP manager is also obligated to conduct periodic maintenance work of the plant per the predefined schedule. This work can be entrusted to a PAWTP maintenance vendor.

Special measures must be taken to ensure adequate O&M and desludging for large-scale PAWTP units (equivalent to more than 500 persons). For such units, the PAWTP manager must deploy a PAWTP technical supervisor. This is to ensure that non-household units (e.g., office complexes and apartment buildings), which produce a large quantity of wastewater in a limited area, are adequately managed.

Whereas the prefectural governor designates the PAWTP inspectors, only those PAWTP maintenance vendors who are registered by the relevant prefectural governor and who can deploy a JECES-certified PAWTP operator to the actual O&M worksite can be engaged.

The municipality ensures compliance by PAWTP managers for the abovementioned mandates. Based on the results of the inspection, the provincial government may issue an order to improve the O&M or desludging procedures.

### *Regular Desludging by Qualified Desludging Workers*

In Japan, regular desludging is implemented as part of the decentralized wastewater management system. The PAWTP Act obligates PAWTP managers to periodically (once a year) conduct desludging works, which can be entrusted to a municipality-approved desludging vendor. The municipality ensures compliance with the law.

A corporate body that intends to join the PAWTP desludging business needs to obtain the approval of the mayor of the targeted municipality. This approval may be given for a limited period and is issued if the desludging equipment and capability of the entity applying as a PAWTP desludging vendor conform to the technical standards prescribed by the ministerial

ordinance. The applicant must also show that the company has not violated any of the terms of the PAWTP Act during the preceding 2 years. Although training and national examination are not legally mandatory for the desludging workers, since the desludging vendor is subject to municipality approval, many municipalities apply the condition that the vendor employ certified desludging technicians who have completed the JECES training course. Therefore, in reality, only trained professionals can engage in desludging works.

In addition, municipalities are obligated to support the job transfer of desludging workers according to the Act on Special Measures Concerning Streamlining of Domestic Waste Disposal Business Incidental to Improvement of Sewerage (1975) in order to protect the desludging workers from anticipated unemployment.

## **Institutional Framework for New Technology**

Although O&M of the existing system is thought to be critical for the sustainability of fecal sludge management (FSM) solutions, there is also a need for a framework for developing new technology. Many developing countries tend to rely on conventional FSM technologies and usually lack an arrangement where new types of technologies can be developed and tested for conformity with effluent water quality standards. The case of Japan is relevant towards this discussion, insofar as a PAWTP manufacturer is free to propose new designs and seek approval after undergoing testing through a designated testing institution. Such a framework may be effective with participation from a range of stakeholders, such as academicians and entrepreneurs.

## **Adequate Installation of the Decentralized Wastewater Treatment Facilities**

Inadequate installation not only could affect the quality of the effluent but also could hinder the desludging process. Lessons from Japan suggest that standardized treatment facilities could provide an optimal solution. However, a more feasible solution would be to ensure the quality of installation works by introducing a qualification and training system for installation. Other solutions focus on the use of new technology to mitigate the harmful effects of existing inadequately

## “priority should be given to improve access to safely managed FSM services where the user’s willingness to pay can gradually be improved by providing efficient services”

installed decentralized wastewater treatment facilities. For example, the development of affordable sensors that can keep long-term records of effluent quality, combined with geographic information mapping tools, could help optimize the desludging patterns and check the water pollution.

### Scheduled Desludging versus On-Demand Desludging

Japan’s experience in establishing and effectively enforcing a set desludging frequency has been a great success. A recent study by the Asian Development Bank (Huang 2018) highlighting an example from Indonesia, a developing country, also demonstrates that the volume of treated sludge increased significantly after a scheduled desludging campaign began in 2015. The same study also showed a sharp decrease in the number of septic tanks being desludged in Malaysia after 2008, when desludging became optional. These examples reveal that scheduled desludging and its effective enforcement are essential even in developing country contexts.

Moreover, discussions of desludging frequency should be considered in tandem with desludging fees. The cost of desludging is seen as a heavy burden for many households in developing countries. Considering the “user-pay principle,” ideas such as the cross-subsidization of desludging from the rich to the poor or from commercial to household users and so on should be considered. The Philippines and Indonesia have adopted an approach that combines desludging fees with water bills. This was found to be effective and acceptable to households.

Another, rather unconventional, approach that emerged from the discussions on ensuring the sustainability of the scheduled desludging vouched for accounting the *spillover effects* of FSM. ADBI has documented the experience of Dumaguete City in the Philippines, where the successful management of FSM increased the number of tourists to the city and, in turn, the number of tourist-related businesses. Having realized the value added by an efficiently managed FSM in the form of increased efficiency of their staff and expanded business,

such businesses are then willing to pay for quality FSM services. Thus, in the proposed novel approach, priority should be given to improve access to safely managed FSM services where the user’s willingness to pay can gradually be improved by providing efficient services. Nevertheless, the Dumaguete study has demonstrated that it is also possible to recover the costs of FSM provision by monetizing its spillover effects, including increases in property tax revenues.

### Regulation of the Desludging Business and Workers

Considering Japan’s experience, one effective suggestion is for the government to establish a training system for desludging workers—and one in which only properly trained workers are allowed to engage in desludging activities so that the municipal regulatory authority can direct and manage them, train them, and promote their standing in the community.

However, a number of factors could affect the implementation of such policies in developing countries. Lessons from the World Bank’s experience in India highlight that the number of fecal sludge treatment plants played a critical role in regulating the informal private sector involved in desludging services. When treatment facilities are sparse, the cost of delivering the collected sludge to a treatment facility is high—thus, the informal sector has no or little value addition when they are formalized. WaterAid, a global nongovernment organization, has experienced in the context of India that the lack of visibility of the desludging workers itself posed a challenge toward formalizing the people involved.

Given such challenges, alternative policy options become relevant. For instance, a scheduled desludging system, when effectively implemented, will create opportunities for informal private sector businesses to join the regulated system. Other ideas to improve the formalization of desludging workers include developing enterprises for the sanitation workers and improving the desludging fee payment contracts between the desludging vendors and public entities.

## Focus on Non-Household Users

Although the focus of the United Nations Sustainable Development Goal on safely managed sanitation has been on household-level users, non-household users, such as big apartment complexes, offices, and shopping complexes, can generate large quantities of waste in a small area, thus contributing to the water pollution problem. Considering the experience in Japan, one recommendation is to have a qualification and training system for the operators of advanced decentralized wastewater treatment systems (PAWTP or similar facilities) for commercial buildings. In addition, there is a need to strengthen the enforcement of the penalty for non-household users who fail to engage such qualified operators and to deploy qualified technical supervisors for their large-scale systems.

## Policy Recommendations

Governments may wish to consider the following policy recommendations:

- Institutional framework for new technology
  - Allow the currently prevailing anaerobic-type wastewater treatment facilities, on the condition that their maintenance, including sludge management, be substantially improved.
  - Promote the conversion of aerobic PAWTP or similar facilities for non-household users and high-income households.
  - Establish an institutional framework including a system to test new technology so that larger stakeholders of the sanitation spectrum can contribute through the development of new technology.
- Qualification and training system for the installation of decentralized wastewater treatment facilities
  - Most desirable is for treatment facilities to be standardized as per structural standards and performance testing systems.
  - Introduce a qualification and training system for installation to ensure the quality of installation works (of diversified designs of decentralized wastewater treatment facilities) for a realistic policy measure.
- Establishment and enforcement of a regular desludging system
  - Establish desludging frequency as a rule, and enforce compliance. The timing of desludging should not be left to the users.
  - In developing countries, the cost of desludging is a heavy burden for households. This may require some form of cross-subsidization from the rich to the poor or from commercial users to household users.
  - Potentially give priority to first provide access to safely managed services and then monetize users' increased willingness to pay once they realize the value addition of the FSM service.
  - Promote means to monetize the spillover effects of FSM.
- Regulation of the desludging business and workers
  - As a first step, politicians and administrators are urged to hold discussions with existing desludging businesses and/or workers to get a feel for the situation on the ground and their demands for a better working environment.
  - Establish a training system for desludging workers, specifically one in which only properly trained workers are allowed to engage in desludging activities so that the regulatory authority can direct and manage them, train them, and promote their social standing.
  - Possible alternative measures include increasing the number of treatment facilities, improving the payment contracts of sanitation workers, and increasing the visibility of sanitation workers through the formation of enterprises.
- Focus on non-household users
  - Establish a qualification and training system for the operators of advanced decentralized wastewater treatment systems (PAWTP or similar facilities) for commercial buildings.
  - Strengthen the penalty on non-household users who fail to engage qualified operators and deploy qualified technical supervisors for large-scale systems.

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