

Key Points

- Development finance has largely been directed towards centralized systems of wastewater management, which has resulted in large populations being excluded from proper wastewater collection and treatment services.
- In order to ensure the success of decentralized sanitation strategies, there is a need for institutional reform and the setting up of robust frameworks.
- The spillover effects of proper sanitation, which include an increase in property tax revenues, can help to offset the costs of fecal sludge management.

Achieving Sustainable Sanitation in Asia

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Introduction

Five thousand years ago, when the urban residents of the Sarasvati-Sindhu civilization sat on their toilets, their rural brethren used the fields to defecate. In both the urban and rural models of sanitation, nutrients were recycled via natural fertilizers, and water bodies were not used for dumping raw waste. Ancient Sanskrit oral texts lay out the importance of not allowing human waste, blood, or hazardous substances to contaminate water bodies under any circumstances. Accordingly, defecation was always conducted in distant, uninhabited places, after which feces were covered with soil, and the left hand was used for washing with small amounts of water. Natural plant-based soaps or sand were used to wash the left hand, which would still not be used for eating, just as a precaution. Cholera epidemics were unheard of in ancient India.

In contrast, London's sewer commissioners "proudly noted the huge volume of human waste that the city's toilets efficiently deposited into the river (Thames); 29,000 cubic yards in the spring of 1848 and 80,000 cubic yards by the winter of 1849" (Shah 2016). It was a period when Europe was in the grip of the miasma theory, now obsolete, which guided the people into believing that the banishing of odors led to a banishing of diseases. Thus, flush toilets enjoyed a spike in sales even as sewage from those toilets fouled the Thames and led to a massive cholera epidemic causing many deaths. But, the connection between fecal matter being sent into the river and the cholera outbreaks that kept descending on London was not made until the late 1800s.

In the last 100 years, the world has made dizzying advances in science and technology. There is awareness about the direct link between poor sanitation and disease, school dropouts, loss of livelihood, and women's disempowerment. Besides, many have pointed out the anomaly of living in an advanced age of space travel, mobile telephony, nanotechnology, and 3D printing while the most basic service of sanitation is not available to millions.



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Goal-Setting for Sanitation: A Brief Overview

In 1977, a global meeting of political leaders was held for the first time to discuss the importance of clean water supply and wastewater management at Mar del Plata in Argentina. The International Decade of Water Supply and Sanitation was declared with the objective of providing clean water and sanitation to every person by the year 1990. On hindsight, this was clearly an impossible target to achieve—however, millions of people did receive coverage during the decade (Biswas 2004).

Subsequently, the Millennium Development Goals (MDGs) were laid out to be achieved between 1990 and 2015. One of the goals set was to reduce by half the number of people without access to clean water. Sanitation was added to the goal later during the Johannesburg Summit in 2002. Considerable discussion was directed towards achieving the MDGs by Asian countries, however the goal of halving the number of people without access to sanitation could not be met by many countries. Even as the MDGs aimed to reduce the number of unserved people, the population explosion ensured there were ever-increasing numbers of people who needed to be served. It was akin to aiming at a moving target. There were problems with measuring and monitoring the progress in achieving the goals. The MDGs have made way for the more ambitious and nuanced Sustainable Development Goals (SDGs) for 2015–2030. Achieving universal and equitable access to safe and affordable water, sanitation, and hygiene; ending open defecation; and paying special attention to the needs of women form a central part of the clean water and sanitation goal (SDG 6) (Jägerskog et al. 2015).

It must not be forgotten that access does not equal service delivery. Governments have the important task of building capacity as well as institutions in order to ensure proper delivery. The systems also need to be maintained and monitored. The build-neglect-rebuild syndrome has been the bane of many a development project.

Excessive Focus on Centralized Wastewater Management

It is well known that around 2.3 billion people in the world lack access to basic sanitation. A large number of these live in the developing member countries of the Asian Development Bank (ADB).

For many years, development finance has been directed toward centralized systems of wastewater management involving the construction of sewers and treatment plants. This has not only entailed considerable capital investment but also long time periods for planning and commissioning because of the complexities involved. Such systems are suitable for places with high and reliable water consumption and are typically not built in rural or low-income areas. In addition, big-budget projects often suffer from political and funding manipulations. The centralized approach has resulted in large populations being excluded from proper wastewater collection and treatment services.

When the Clean Water Act was passed in the United States during the 1970s, it was assumed that it was only a matter of time before centralized sewerage facilities would be available across the country (Hophmayer-Tokich 2006). Over the years came the sobering realization that the timeframe and resources needed to deliver an overarching centralized sanitation solution for the country were beyond the realm of practical actions. The Bill and Melinda Gates Foundation states in its strategy overview:

The toilets, sewers, and wastewater treatment systems that made sense in the past aren't necessarily the best solutions for the future, especially in poor countries. These types of systems require vast amounts of land, energy, and water and are extremely expensive to build, maintain, and operate, even by western standards. They are particularly difficult to introduce, as new infrastructure, into dense urban settings and informal settlements, where the impact of unsafe sanitation on people is the greatest. (Bill and Melinda Gates Foundation, n.d.)

Stepmotherly Treatment toward Decentralized Wastewater Systems Must Stop

From 2003 to 2016, ADB invested \$681.14 million in the People's Republic of China, followed by India (\$153.70 million), Indonesia (\$56.64 million), Fiji (\$37.09 million), and Viet Nam (\$34.96 million). Sewerage networks formed an important component of these investments. An independent evaluation noted that out of 63 projects, only seven had both off-site (sewers) and on-site (septic tanks and latrines) wastewater treatment components (ADB 2018).

Meanwhile, even as more development finance is being directed towards centralized wastewater systems, policy improvements and regulatory efforts are also being focussed on them. This is leaving the arena of decentralized systems in an orphaned position with insufficient finance as well as policy support. Given that decentralized sanitation has the potential to ensure complete coverage of the under-served populations, it is important to change the paradigm.

There are many advantages of a decentralized strategy. Costs are lower because the collection infrastructure is considerably simplified. In a centralized system, finances are invested for a capacity that will only be needed after many years. Thus, a large amount needs to be spent in a short period, thereby imposing a burden on the local economy. In a decentralized system, the components are less complex and more distributed, so simultaneous failure is less common. Most importantly, reuse opportunities for effluents and solids at the local level are increased. The ecological footprint is also smaller (Hophmayer-Tokich 2006).

In Japan, the goal of sanitation for all was achieved through the combination of centralized sewerage systems and decentralized wastewater treatment systems. Packaged aerated wastewater treatment plants (PAWTP, or *johkasou* in Japan), which are compact systems with high performance, were the solution applied for on-site sanitation. In order to turn night soil workers into *johkasou* entrepreneurs, the entire institution was reformed. Robust frameworks were set up to test new technologies as well as ensure their proper installation. Regular desludging is imperative for the successful performance of decentralized systems. Recognizing this,

in Japan, desludging is a legal requirement imposed on the owners of on-site sanitation systems, and it is thoroughly supervised by local governments and implemented by the private sector. There are about 1,100 sludge treatment facilities nationwide that are managed by municipalities to ensure that sludge is safely transported and hygienically treated (Seetha Ram, Hashimoto, and Bugalia 2018; Japan Sanitation Consortium, n.d.).

In the early years, treated sludge was disposed of in sanitary landfills. However, it was realized that in a country with limited land availability, such as Japan, compact and innovative options needed to be explored. Thus, the excess sludge was incinerated along with solid waste. But as the recycling of resources became a more important goal in Japan, cities such as Saitama City chose composting, which had the additional benefit of improving soil (ADB 2016).

Finance Is No Longer a Constraint

In the early days of sanitation financing, it was a difficult task to secure even \$100 million from donors. Also, it was easier to procure finance for water supply projects compared to sanitation projects. According to Hophmayer-Tokich (2006): "lower coverage of drinking water services in the poorer areas means that if they would succeed to provide their entire population with safe centralized drinking water services, it is not likely that sufficient additional financial resources will remain for proper wastewater collection and treatment."

Over the years, there has been a great deal of advocacy on sanitation issues, and attention has focused on the need to invest in toilets in order to help girls stay in school, to be safe from molesters, and to promote health, livelihoods, and productivity. As a result, governments have been allocating finance to sanitation projects. For example, the Government of India allocated ₹113 billion (\$1.5 billion) in its 2016–2017 national budget for Swachh Bharat Abhiyan, its flagship sanitation programme. Out of this, about ₹9 billion was allocated for the rural part of the mission, while the rest was for urban sanitation (Dutta 2017). The mission to clean the Ganga River is giving birth to many wastewater management projects in India. From 2005 to 2015, the People's Republic of China also spent large amounts on wastewater treatment. Other countries in Asia and Africa are expected to follow a similar pattern.

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Wastewater management has become impossible to ignore, and new ways to finance it are being sought. Commercial finance, which includes microfinance, commercial loans, and bonds, is the largest untapped source. It helps to bring in transparency and accountability as well as reduce the foreign-exchange rate risk, even though it is initially more expensive. Governments have a role to play in fostering the relationships between sanitation providers and the domestic providers of commercial finance (World Bank and UNESCO 2017).

Another interesting development is that philanthropists are donating trillions, as compared to billions in the past decade, and some of the money is going to wastewater management. In 2011, the Bill and Melinda Gates Foundation announced the “Reinvent the Toilet Challenge” to researchers around the world to develop innovative and financially profitable systems to manage human waste that would be off-grid and cost less than \$0.05 per day. Millions of dollars of grants have been awarded to researchers so far, and the challenge is now in its third phase. According to the grant database of the Bill and Melinda Gates Foundation, during the period between 2008 and mid-2015, the grants awarded to water, sanitation, and hygiene projects totalled a value of around \$650 million (Moses 2017; Bill and Melinda Gates Foundation, n.d.).

Let the Spillover Effect Show Its Magic

The spillover effects of good infrastructure have been well observed. The benefits of a rail or road project are not confined to better transportation alone but tend to spill over to areas such as the service sector (restaurants, hotels, banks, shopping malls, schools, and colleges) and industrial development. In a recent study, Yoshino, Abidhadjaev, and Nakahigashi (2018) point out that the spillover effects of infrastructure investment can increase the revenue from corporate, property, income, and sales taxes. Typically, these taxes are collected by the government and not returned to investors as a budget subsidy—but why not pass on the benefits of the spillovers to investors by offering a higher rate of return on infrastructure investment and thereby making it

attractive for them? The authors argue that the difference-in-difference method can be used to compute the effect of spillovers on gross domestic product or tax revenues in places where investment occurred compared to places where no infrastructure investment took place.

Thus, the spillover effect is the increment of tax revenue in the affected region compared to the tax revenue in a non-affected region. Yoshino, Abidhadjaev, and Nakahigashi (2018) also estimate that returning part of the additional tax revenue from the spillovers to construction companies and investors in the form of subsidies would raise the rate of return on infrastructure investment by 39%–43% in the case of Japan and by 14%–16% in the case of Uzbekistan.

In a broad sense, there is nothing new about using taxpayers’ money for infrastructure spending. But blended finance to catalyze new funding for sanitation projects can be an important approach for achieving development. If user charges are the only source of returning investors’ money, sanitation projects will have unattractive rates of return. This is why using government subsidies created by accounting for the spillover effect in order to attract private financing is a timely idea.

A recent study in Jaipur, which investigated the socioeconomic spillovers resulting from the deployment of sewage treatment plants (STPs), was presented at a workshop in Singapore in July 2018 (ADBI 2018). The study concludes that the overall lifestyle and living conditions of the residents of the area have significantly improved. The land prices prior to and after the commissioning of sewage treatment plants over a period of 20–30 years indicate a rise of around 100–250 times. This trend has subsequently brought huge infrastructure growth in the area.

Another study by ADBI of Dumaguete City in the Philippines notes the spillover effect of fecal sludge management (FSM) (Seetha Ram, Hashimoto, and Bugalia 2018). Not only did the number of tourists increase but so did tourist-related businesses when a scheduled desludging of septic tanks was implemented all over the city. These businesses, which benefitted from efficient FSM, were willing to pay more for quality services. The Dumaguete City experience clearly indicates that the

costs of FSM can be more than offset by monetizing the spillover effects of proper sanitation, including an increase in property tax revenues.

No More Dithering on the Recycling of Nutrients

One area which has been largely ignored in the context of sanitation is nutrient recovery. As Juuti, Katko, and Vuorinen (2007) explain in the *Brief History of Wells and Toilets*:

It is notable that in the 19th century there were already dry compost and compost toilets in cities combined with different transport systems. Choosing the water closet as the primary system in the late 19th and early 20th centuries ended the product development of dry compost and compost toilets for over a hundred years.

Today, humans are going through the elaborate process of mining and processing to manufacture fertilizers, then applying them to crops and then losing it all via wastewater. This is because most treatment plants do not recover the excess phosphate, nitrogen, potassium, or other nutrients that are excreted by humans, thus allowing them to discharge them into water bodies or land. The nutrients go through a linear process instead of being recycled back to crops. As a result, receiving water bodies are suffering from eutrophication and serious ecological effects, such as fish-kills (Singh 2018).

Importing fertilizers is causing a drain on many countries, such as India, because phosphorous reserves are confined to a few countries. Currently, India imports about 90% of its requirement for phosphate fertilizers (Himanshu 2015). Many Asian countries are net importers of phosphate and potash-based fertilizers. According to 2011 data, the United States imports about 85% of its potash fertilizers and 50% of its nitrogen fertilizers (United States Department of Agriculture 2016). A strong case can be made for saving foreign exchange by focussing on nutrient recovery.

Ecological sanitation (ecosan) must be pushed forward vigorously along with the decentralized model of sanitation. There are many shining examples of decentralized sanitation with fecal sludge management that ensure nutrient recovery, such as Aravind Eye Hospital in Pondicherry and Indian Institute of Technology in Gandhinagar (Borda, n.d.). In Musiri in the Indian state of Tamil Nadu, the organization SCOPE has introduced public ecosan toilets that close the nutrient cycle and work efficiently even during periods of heavy rain when the water table is high (Joshi 2016). The “Reinvent the Toilet Challenge” mentioned earlier has led to the development of many varieties of ecosan toilets in addition to the others that have already been in use for many years. There is a need to scale up the successful pilot applications of ecosan toilets.

No One Should Be Left Behind—It Can Be Done

It has been estimated that meeting SDG targets 6.1 and 6.2 would cost about \$112 billion per year (ranging from \$74 billion to \$166 billion) (Chen 2017). According to the 2017 report *Meeting Asia's Infrastructure Needs* (ADB 2017), the water and sanitation sector needs an investment of \$787 billion, which is far smaller than the requirements of the power, transportation, and telecommunications sectors.

No man or woman is an island. Our fates are interconnected. It is becoming increasingly obvious that making safe sanitation available to just a portion of humanity will not suffice because the ill effects of the lack of safe sanitation to the remaining portion will not be confined just to them. It is evident that the poor sanitation and hygiene afflicting urban slums do not spare even the richer areas adjacent to them. The same groundwater is shared by both rich and poor areas; when rivers and lakes get polluted, it affects rich and poor, rural and urban populations. The only path forward is to pull up the entire mass of humanity with the thread of complete and equitable sanitation. It can be done.

“Making safe sanitation available to just a portion of humanity will not suffice.”

Box 1. Sanitation for All from Now—The Tokyo Statement

The Asian Development Bank Institute (ADBI), in partnership with the Bill and Melinda Gates Foundation, hosted the Development Partner Roundtable and Policy Dialogue on Sustainable Sanitation in Asia during 20–22 September 2018 in Tokyo. The event culminated in a statement signed by all participants seeking to accelerate the pace of achieving Target 6.2 of the Sustainable Development Goals for sanitation. No matter how poor the existing sanitation is, there is a way to improve it now—this was the overarching message from the participants.

More than 28 experts from various multilateral and bilateral development agencies as well as other partners assembled to brainstorm ways to scale up and accelerate city-wide inclusive sanitation and fecal sludge management. Instead of simply brainstorming at different roundtables, an intelligent and innovative structure was introduced by i.school, University of Tokyo, which specializes in facilitating “human-centered innovation.” On the next day, government officials from nine countries and other stakeholders joined for a policy dialogue session, at the end of which it was unanimously decided to secure “Sanitation for All from Now.” (For more information see Statements on the Way Forward to Achieve Target 6.2.)

A video case study of Dumaguete in Philippines was also presented to the delegates in Tokyo. Dumaguete’s city-wide fecal sludge management program has led to the city seeing not only higher property values and improved tourism but more jobs and better health and productivity.

Box 2. When Bill Gates Took a Beaker of Poop on Stage to Make a Point

At the Reinvented Toilet Expo in Beijing held in November 2018, Bill Gates highlighted the message of safe sanitation in a dramatic manner—by taking a beaker of poop with him on stage. He reminded that unsafe sanitation puts a huge economic burden on countries that can least afford it. “Globally, it costs an estimated \$223 billion a year in the form of higher health costs and lost productivity and wages,” he said.

Gates warned that population growth, urbanization, and water scarcity over the next few decades will make it even more difficult for cities in Africa and Asia—cities that are already struggling with inadequate sanitation systems—to break the cycle of disease and poverty associated with unsafe sanitation.

In 2009, the iconic founder of Microsoft Corporation had posed a question to a group of scientists and engineers: Was it possible to leapfrog the long-accepted “gold standard” of sanitation: flush toilets, sewers, and treatment plants?

He re-framed the question again at the Beijing 2018 expo: “Could we come up with a more affordable approach that could kill pathogens and keep pace with the needs of fast-growing urban areas—without requiring sewer infrastructure or reliance on scarce water resources or continuous electricity to operate?”

Recalling how it had seemed impossible in the era of mainframe computers to even think that personal computers could one day be available to every person, Gates said that a similar mindset had to be overcome in the field of sanitation. Nevertheless, his foundation worked with partners to develop a small-scale treatment plant to process fecal sludge and biosolids from pit latrines, septic tanks, and sewers. “The self-powered technology—which can be located almost anywhere—is called the Omni-Processor,” said Gates. “It takes in human waste, kills dangerous pathogens, and converts the resulting materials into products with potential commercial value—like clean water, electricity, and fertilizer.”

The foundation also pushed inventors to invent a “pathogen-killing toilet that is also self-contained—with a tiny treatment plant built in.” “We call this the “reinvented toilet,” which is actually a collection of innovative technologies that use different approaches to break down human waste and destroy germs, leaving behind clean water and solids that can be used as fertilizer ... or that can be disposed of safely outdoors without further treatment,” said Gates.

The philanthropist predicted that as the adoption of these multi-unit toilets increases, the cost would continue to drop, and a new category of reinvented toilets would become available for use in people’s homes in developing countries where people have limited resources and in developed countries for people who needed an off-grid household toilet.

At the Beijing expo, for the first time, “radically new and pilot-tested approaches to sanitation that will provide effective alternatives for collecting, managing, and treating human waste” were unveiled, which were the most “significant advances in sanitation in nearly 200 years”.

Gates believes that a new generation of reinvented toilets will create a global business opportunity of \$6 billion a year, and this number will be much higher if the Omni-Processor and related products and services were included. He mentioned that more than 20 companies are business-ready with innovative, non-sewered sanitation products.

It is not enough for companies to be interested in making and selling new products, according to Gates. He observed that national and local governments must create an enabling environment with policies and regulations that encourage innovative sanitation service models, including with the private sector.

“We try to be thoughtful about the role of philanthropy—and one of the things we’re best placed to do is lower barriers and risk for the private sector and for governments to adopt new solutions to solve big problems,” said Gates.

Please visit <https://www.gatesnotes.com/Development/Reinvent-the-Toilet-Expo-speech> for the full speech delivered by Bill Gates at the Reinvented Toilet Expo 2018.

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