Supplementary Chapter Environmental Sanitation

Focus: Water Supply and Waste Disposal, and Sewage Treatment

Even today in the twenty-first century, some eighty countries around the world do not have adequate water supplies. Of the world's 6 billion people, one billion do not have ready access to safe potable water, and at least one million children die each year from sicknesses caused from drinking contaminated water. While these figures basically highlight the North-South gap in how people's basic water and sanitation needs are being met, in recent years even in developing countries that gap has been widening between more affluent classes and lower-income classes[1]. International concern is growing about this water problem in developing countries, and at the 3rd World Water Forum held in Japan in March 2003, criticism was voiced at the tardiness in securing safe and sanitary potable water supplies in developing countries. The Forum confirmed the need for countries around the world to assist with this issue.

Until the end of the post-war period, Japan too faced the same sort of problems as developing countries today. However as its economic strength increased, the nation slowly worked towards improving its sanitation, with the aim of supporting the health of the populace.

In this Chapter, we will examine how environmental sanitation was improved in Japan, tracing the improvement process by focusing in particular on the provision of water supply and waste disposal services, and sewage treatment infrastructure. We will then discuss the possibilities that Japan's experience can be utilized as a reference to improve environmental sanitation in today's developing countries.

1. Trends in Environmental Sanitation

1-1 Pre-war Environmental Sanitation Projects (1868~1945)

Around the start of the Meiji Era in the early 1870s, some early interest was shown in environmental sanitation measures such as potable water distribution systems, waste disposal programs, sewage systems and improving the standard of residential designs, as measures to eliminate sources of infectious diseases, and cholera in particular. Occupied with the immediate response to whichever infectious disease was sweeping the country at any particular moment, the Japanese Government had few resources to spare for sanitation measures[2].

In the late 1880s, when measures to combat cholera had finally achieved some results, the government began work on plans to improve the nation's water supply and sewage systems. Due to financial considerations, the decision was taken at that time to give priority to providing water supply services, for which the need across the country was deemed to be greater. Construction of sewage systems, although an essential weapon in the battle against infectious diseases, was put on hold until the country's economic resources permitted. Accordingly the first modern water supply facility built in Japan

---

1 Institute for International Cooperation, Japan International Cooperation Agency (2002) "*Tojokoku no Sosharu Sefuti Netto no Kakuritsu nimukete* [Toward Development of Japan's Social Security System in Developing Countries] Japan International Cooperation Agency.

2 The Ministry of Health and Welfare (1988) *Kosei Sho Goju-nen Shi (Kijutsu-hen)* [Fifty Year's History, Ministry of Health and Welfare (Descriptive Version)] Kosei Mondai Kenkyukai.

was the Yokohama Water Supply in 1887. After their creation in 1889, local governments across Japan drew up plans for their own water supply systems. The Waterworks Law (obsolete law) was promulgated and enacted in 1890, leading to efforts to set up water supply infrastructure in regions throughout Japan. This Ordinance provided the regulatory framework for water supply in Japan until the implementation of the Waterworks Law in 1957.

In the meantime, owing to the above-mentioned financial considerations, the sewerage infrastructure made little progress. It was not until the latter part of the Meiji Era, from 1890 onwards, after the nation's water supply projects had by and large been completed and society's attention had turned to sanitation issues, that progress began to be made in constructing sewerage systems. The chief purpose of the nation's drains at that time was to remove rainwater and liquid waste - night soil on the other hand was physically collected and returned to agricultural areas, for use as fertilizer. This separation of the two types of waste commenced when each came under the operation of their own law, namely the Sewerage Law and the Waste Management Law (obsolete law), both enacted in 1900.

During the Taisho Era (1912~1926), a sewage water treatment plant using a percolating filter method was constructed in Tokyo, and it began treating mainly liquid waste from March 1922. Around this time chemical fertilizers came onto the market as a substitute for night soil in Japan, and at the same time the country experienced a period of accelerated urbanization. This caused the existing balance to break down between the supply and demand for night soil between cities and the surrounding countryside, and in Tokyo and other large cities the disposal of night soil became a problem. The Tokyo city government began to treat night soil by sending to its sewage water treatment plant some of the night soil that accumulated in the main drains in the areas served by the plant.[3] Prior to 1945 however, the construction of sewage facilities did not make much progress, with just twelve plants at the end of the Meiji Era, thirty by the end of the Taisho Era, and fifty in 1940[4].

1-2 Post-war Provision of Water and Sewage Systems (1946~1979)

Even in cities where progress had been made in constructing water supply facilities, due to war damage and inadequate management systems in the immediate post-war period, Japan's water supply capacity fell to an extremely low point. Subsequently in the 1950s, water supply projects were pursued with some vigor, with the active expansion and improvement of the country's existing water distribution facilities.

Although accurate records are lacking, in the chaotic conditions immediately following the war around 25% of the population was thought to be connected to water supply services. This period nevertheless provided abundant opportunities for urban revitalization of a high standard, and many plans were produced for new water distribution projects[5]. The event that served as the direct turning point for promoting water supply projects was the Nankai Earthquake of 1946. Small-scale water supply projects introduced into rural and mountain villages affected by the earthquake met

---

[3] Institute for International Cooperation, Japan International Cooperation Agency (1995) *Kaihatsu Tojokoku no Toshi niokeru Shinyo, Zatsuhaisui Shori no Dankaiteki Kaizenkeikaku Shuho no Kaihatu ni kansuru Kenkyu* [Research on Development of Improvement Planning Technique for Night Soil and Drainage Treatment in Developing Countries] Japan International Cooperation Agency.

[4] Health and Welfare Statistics Association (2003) *Kokumin Eisei no Doko, Kosei no Shihyo* [Activities in National Health, Welfare Indicators] 2003 Vol. 50 No. 9. No. 784. Health and Welfare Statistics Association.

[5] Ishibashi, Tabun (1975) "*Kani Suido ha 'Kokuminkaisuido' no Ninaite*, [Private Water-supply System is Bearer of 'Universal Water-system Coverage']," *Kani Suido no 20-nen* [Private Water-supply System in 20 Years] Zenkoku Kani Suido Kyokai.

with great public approval. The popularity of the scheme lead to small-scale water supply assistance projects around the country. This in turn encouraged water supply projects in urban areas, and to replace the 1890 Waterworks Law (obsolete law) the Waterworks Law was enacted in 1957, providing serious incentives for the construction of water supply projects[6]. At the same time, government financial assistance was discontinued for projects other than small-scale water supply projects, and responsibility for water supply projects was subsequently entrusted to local governments. As a result of these policies, the national water supply penetration rate, which had been 32.4% in 1955, rose to 53.4% in 1960, and 80.8% in 1970.

In the 1960s, the main issue facing the nation was the need to put more resources into the nation's living conditions, meaning more and better roads, public transport, housing, and environmental sanitation. While the 1957 Waterworks Law provided a favorable basis for the construction, management and operation of water supply services, throughout Japan water distribution capacity was unable to keep pace with the growth in demand for mains water resulting from the country's strong economic growth. In particular in metropolises such as Tokyo and Osaka, inadequate water pressure and poor water supplies were a regular occurrence. The Ministry of Health and Welfare drew up a Water Supply Infrastructure Ten-year Plan, covering the period from 1961 to 1970, setting non-binding targets for the construction of water supply infrastructure. The basic strategies adopted to overcome water shortages were firstly to secure funding for local governments (who were responsible for building water supply projects), and secondly to secure reservoirs and other water sources for the supply network. At first almost all funding for water infrastructure projects was met by bonds issued by municipal governments. As the assets underlying the nation's pension reserves grew, however, it was made easier for councils to raise the necessary capital when the ceiling was raised for Japan's Fiscal Investment and Loan Program (FILP: under this program, a certain percentage of the reserves for welfare pensions and national pensions deposited with the Ministry of Finance can be used to fund projects that improve the overall welfare of Japanese society). Progress was made in securing water sources in 1961, when the Water Resources Development Promotion Law and the Water Resources Development Corporation Law were enacted, whose aims were the comprehensive development of water resources and their utilization over broad areas of the country[7]. As a result of all these policies, the water supply penetration rate rose steadily, reaching 87% in 1975.

Comparing the trend in this rate against the prevalence of water-borne infectious diseases, a clear correlation can be seen from around 1960, when the water supply penetration rate passed 50%. We can also see that water-borne infectious diseases completely disappeared when the water supply penetration rate exceeded 80% (see Figure S-1)[8].

National government subsidization of sewage projects began in 1957. Plans for comprehensive improvements to social infrastructure, including living environment infrastructure such as sewage systems and sewage treatment plants, were first taken up in the National Income Doubling Program of 1960 (covering the period 1960 ~ 1970). Based on this in 1963, the Law for Promotion of Construction of Sewerage and Waste Management Facilities was enacted,

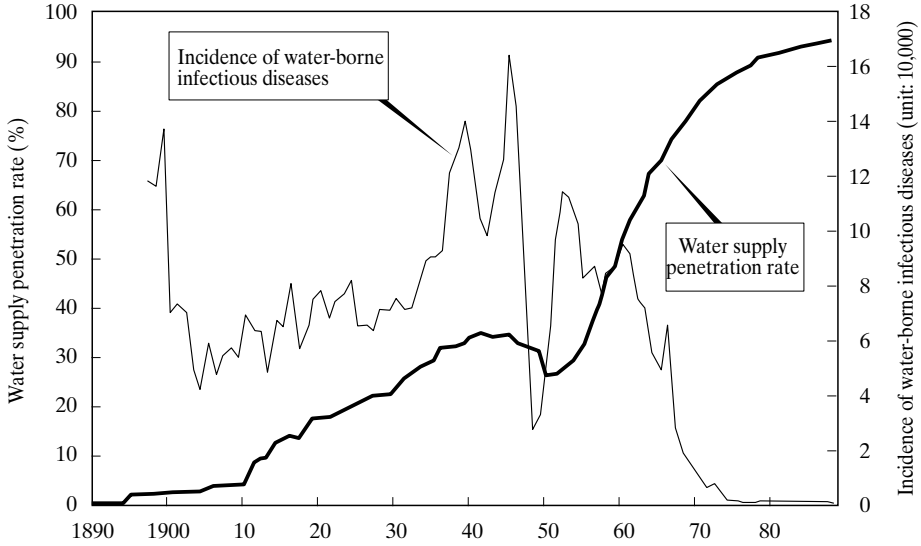
---

6 The Ministry of Health and Welfare (1988) *Kosei Sho Goju-nen Shi (Kijutsu-hen)* [Fifty Year's History, Ministry of Health and Welfare (descriptive version)] Kosei Mondai Kenkyukai.

7 *ibid.*

8 See Health and Welfare Statistics Association (2003) *Kokumin Eisei no Doko, Kosei no Shihyo* [Activities in National Health, Welfare Indicators] 2003 Vol. 50 No. 9. No. 784. Health and Welfare Statistics Association. p. 268.

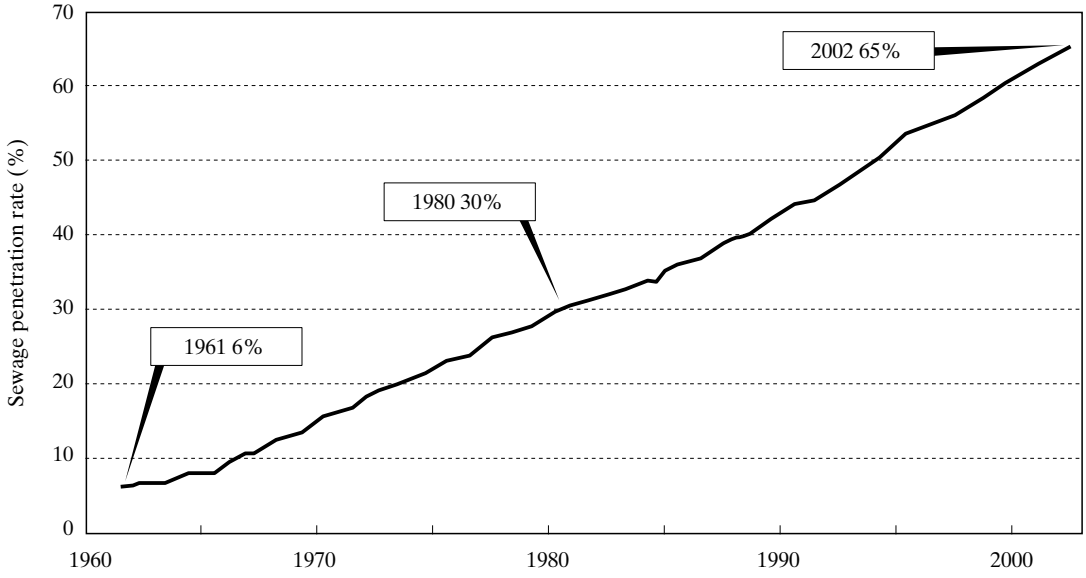
Figure S-1 Water Supply Penetration Rate and Prevalence of Water-borne Infectious Disease



Note: Water supply penetration rates were calculated based on the figures for planned water supplied populations in the History of Japan's Water Supplies (for the period 1890~1949); the water supplied population from water supply statistics (1950~1955); and the water supplied population from water supply statistics (1956~1988). The incidence of water-borne infectious diseases is the total number of cases of cholera, dysentery, typhoid, and paratyphoid. The data for all diseases dates from 1897, excepting paratyphoid which dates from 1911, as there are no clear figures for that disease prior to that year.

Source: Water supply penetration rates were prepared based on "A Century of Modern Water Supplies" (1987; ed. Editorial Committee). The figures for water-borne infections were prepared based on data compiled by the Ministerial Secretariat Statistics and Information Department of the Ministry of Health and Welfare (2000).

Figure S-2 Trends in Sewage Penetration Rate



Source: Prepared based on Japan Sewage Services Association's homepage (http://www.alpha-web.ne.jp/jswa/05_arekore/01_his/index.htlm)

commencing budgeting by the government for subsidies for waste water systems and sewage treatment projects. Now that funding had been secured, and priority given for the construction of living environment infrastructure, sewage systems along with sewage and gray water treatment plants were established around the country at a steady pace (see Figure S-1)[9].

Along with improvements in peoples' standard of living, the total volume of waste increased and the waste was diversified such as oversize garbage, plastics of various types, and packaging. Further, the treatment of industrial waste, being generated in huge quantities in the course of the nation's industrial activities, constituted another serious social problem. At that point the government decided to make businesses liable and responsible for treating industrial waste, just as it had with industrial pollution. So in 1970 it introduced legislation for a system for the disposal of waste products, using the Waste Management and Public Cleansing Law to regulate general waste products that came within the jurisdiction of local municipal governments. Making it the express responsibility of the nation's businesses to treat waste products and clearly defining disposal standards represented an epochal shift in particular, and also constituted a major step forward in the subsequent regulation of waste disposal[10].

1-3 Water Quality Preservation and Sewage Treatment (1980~present)

In 1980 the water supply penetration rate exceeded 90%, representing a significant achievement in the spread of water supply services[11]. However, a number of problems arose concerning water quality and the sources of water supplies, and the natural and socio-economic environment affecting water supply became increasingly severe, with growing obsolescence in the nation's water supply facilities and deterioration in the financial resources of both national and local governments. In these conditions, in order to have stable supplies of water and to ensure water safety, and to strengthen measures for preserving the quality of the nation's water sources, it became important to strengthen water quality management systems by adopting comprehensive water quality standards[12].

Compared to the water supply penetration rate, the sewage penetration rate lagged conspicuously, only reaching 30% by 1980. By this time, non-sewage household waste water had started to generate concern as an environmental problem, so as a method that was cheaper than expanding mains sewage services, small-scale individual household combined wastewater treatment tanks were developed, that treated household gray water together with night soil. Boosted by subsidies from the government, these were taken up by homes throughout the country. At the same time, technological advances were also made in drain water treatment plants and sewage treatment plants, thereby ameliorating sanitation problems. The spread was also subsequently encouraged of flush toilets and mains sewage services, from the perspective of a better global environment and the amenity of individual citizens. As of 2002, the sewage penetration rate for the entire country was still just 65.2% (see Figure S-2). In addition, looking at regional differences, there is a huge disparity between Tokyo, with the highest penetration rate at 97.6%, and Wakayama, the prefecture with the

---

[9] Kitawaki, Hidetoshi (1999) "*Mizu to Eisei Shisetsu* [Water and Sanitation Facilities]," Japan International Cooperation Agency, *Primary Health Care wo Yoku Shiru tameni- Nihon no Keiken wo Fumaete-* [To Understand Primary Health Care - Based on Japan's Experience].

[10] The Ministry of Health and Welfare (1988) *Kosei Sho Goju-nen Shi (Kijutsu hen)* [Fifty Year's History, Ministry of Health and Welfare (Descriptive Version)] Kosei Mondai Kenkyukai.

[11] Notwithstanding the country's high water supply penetration rate (96.6% as of 2000), there still remain some regions that lack the benefits of a water supply service. This is an issue that should be addressed as soon as possible.

[12] Suzuki, Shosuke and Hisamichi, Shigeru eds (2003) *Shinpuru Eisei Koshueisei-gaku* 2003 [Simple Hygiene and Public Health 2003] Nanko Do.

lowest rate at just 11.8%, indicating that in general a large gap in the penetration rate has arisen between urban and rural areas. The government for its part is trying to pursue strategies for household waste water that match Japan's particular circumstances, for example by promoting infrastructure that works in partnership with individual household combined wastewater treatment tanks, as in mountainous regions that do not lend themselves easily to coverage by mains sewage systems.

2. Japan's Main Initiatives

2-1 Roles of Local and National Government in Water Supply and Sewage Infrastructure

Water supply and sewage infrastructure in Japan has essentially been the responsibility of local government. The national government first issued ordinances, and then in the post-war period passed legislation, in order to facilitate local governments in their task. For social capital infrastructure, however, such as sewage systems that have high community value yet require enormous expense, financial assistance from the national government is essential. In Japan too the national government provided support in the form of state subsidies, whereby construction funds were raised in part from the national budget.

For local governments, who were charged with building water supply infrastructure, the problem of securing sources of revenue was a serious one. In Japan's case, these funds were raised by using the nation's pension reserves under its Fiscal Investment and Loan Program (FILP). Under this program, a certain percentage of the reserves for welfare pensions and national pensions managed by the Ministry of Finance could be used to fund projects that improve the overall welfare of Japanese society. This device of using pension reserves as a stable source of finance is something Japan is good at, and it is a scheme with very few counterparts around the world.

2-2 Night Soil Treatment Works Outside the Sewage System

Several factors have been put forward as possible causes for the slow rate of sewage penetration in Japan.[13] Firstly, traditionally night soil was used in agriculture as fertilizer[14]. Secondly, the concentration of population in the country's cities was at first not so rapid. Thirdly, Japan's mountainous terrain does not easily lend itself to mains sewage services.

With the recovery in Japan's economy since 1945, however, and the consequent increased use by its farmers of chemical fertilizers (which also occurred because infestation by roundworm and other parasites in night soil constituted a clear health problem), the agricultural use of night soil gradually declined. On the other hand, the population began to grow in Japan's larger cities, the balance between supply and demand for night soil began to break down considerably, and the disposition of increasing volumes of night soil became a significant problem. In order to deal within this situation, in 1953 Japanese Government began providing government subsidies to promote the construction of sewage treatment plants using anaerobic fermentation treatment methods. In this way by around the 1970s, Japan had overcome its problems with treating sewage, by collecting it from around the

[13] Institute for International Cooperation, Japan International Cooperation Agency (1995) *Kaihatsu Tojokoku no Toshi niokeru Shinyo, Zatsuhaisui Shori no Dankaiteki Kaizenkeikaku Shuho no Kaihatu ni kansuru Kenkyu* [Research on Development of Improvement Planning Technique for Night Soil and Drainage Treatment in Developing Countries] Japan International Cooperation Agency.

[14] Health and Welfare Statistics Association (2003) *Kokumin Eisei no Doko, Kosei no Shihyo* [Activities in National Health, Welfare Indicators] 2003 Vol. 50 No. 9. No. 784. Health and Welfare Statistics Association. p. 271.

country and transporting it to sewage plants for treatment.

In the 1980s, as Japanese people became more affluent they consumed more water, and gray water produced as a result of household activities caused environmental problems such as degradation of the nation's rivers and waterways. In order to deal with the gray water produced by households outside the areas served by mains sewage services, small-scale combined wastewater treatment tanks were developed for private households, the most common tank being for households with no more than ten people. These tanks treated gray water and night soil together, but because they were expensive compared to separate treatment tanks, they were not so popular initially. As the problem of household gray water grew more serious, in 1987 the Ministry of Health and Welfare established a system of government subsidies for the installation of combined wastewater treatment tanks, in an effort to encourage their use around the country. Under this scheme, the subsidy was not paid to the individuals who installed the tanks, instead it was paid to the local municipal government. This lead to a rapid increase in the volumes of household gray water treated[15].

Today the percentage of Japan's population with access to some form of sewage disposal services has reached 98.4%, involving a combination of methods such as mains sewage, treatment tanks, and/or physical collection services. The slow spread of mains sewage services has been overcome, and environmental sanitation problems have receded considerably.

2-3 Spread of Small-scale Water Supply System

Japan's water supply penetration rate, which stood only just above 20% in 1945, exceeded 80% a mere 30 years later. This achievement is so renowned that people in developing countries are keen to learn the secret of Japan's success. Small-scale water supply system are said to have been part of the driving force behind the astonishing progress in the expansion of Japan's water supply network[16]. A small-scale water supply service means a project with a planned water supply population not exceeding 5,000 people, whose sources of water are good quality groundwater or spring water. At the outset, almost none of the target communities had water purification facilities, but they did conduct water quality control.

Small-scale water supply construction projects originated when local residents, who were no longer able to use well water following the Nankai Earthquake of 1946, appealed to the Japanese parliament and government for water services to be constructed for their communities, and in 1950 a financial subsidy system was set up on an experimental basis (the subsidy covered half the cost of a construction project). Following this trial, within just two to three years small-scale water supply system sprang up in hundreds of communities, and these services produced two major outcomes for farming, mountain villages and fishing communities in the form of infectious disease control (see Box S-1) and improved standards of living, attracting attention from around the country. Another major benefit of these services was that they revolutionized the lives of local women, who previously had spent many hours drawing water from wells (see Box S-2). This success inspired members of Japan's parliament, who believed that "politics is directly linked to the kitchen." When the Ministry of Health and Welfare at last recognized the need for these systems from

---

[15] Institute for International Cooperation, Japan International Cooperation Agency (1995) *Kaihatsu Tojokoku no Toshi niokeru Shinyo, Zatsuhaisui Shori no Dankaiteki Kaizenkeikaku Shuho no Kaihatu ni kansuru Kenkyu* [Research on Development of Improvement Planning Technique for Night Soil and Drainage Treatment in Developing Countries] Japan International Cooperation Agency.

[16] Ohashi, Fumio (1975) "*Shogaikoku ga Odoroku Suido Fukyu Tempo* [The Prevalence Speed of Water-supply that Makes Other Countries Surprised]," *Kani Suido no 20-nen* [Private Water-supply System in 20 Years] Zenkoku Kani Suido Kyokai.

Box S-1 Improvements in Public Health from Small-scale Water Supply System

According to Sugito (1955), although there are no clear statistics on the effects that the arrival of small-scale water supply system had on public sanitation, according to a survey of around 300 towns and villages which built these services, on the whole the following effects were said to be observed:

- The incidence of gastrointestinal infectious diseases fell by 88%.
- The incidence of trachoma fell by 49%.
- Infant mortality fell by 26%.
- The incidence of endemic diseases fell by 20%.
- The cost of public health and infectious disease control measures fell by 32%.
- Medical treatment costs fell by 43%.
- The cost of fire damage fell by 80%.

Source: Sugito, Kiyoshi (1955) *Kanisuido no Tebiki* [Handbook for Small-scale Water Supply System] Nihon Suido Shimbun Kyokai

Box S-2 Drawing Water is Hard Labor

In 1957, as part of an attempt to secure funding for a program to subsidize small-scale water supply projects, the Ministry of Health and Welfare prepared the following sample calculations of the time involved in using wells as sources of water supply. What is noteworthy about this information is that the hardships of the sort that many women in developing countries face today from using wells as a water supply were also seen in Japan at that time, and that scientific evidence was used to shape government policies.

(The following is an extract)

Drawing water from wells in farming, mountain villages and fishing communities is principally the responsibility of women and children. The physical and mental hardship of carrying heavy loads of water on wet days or windy days, even on days when it is snowing, can never be truly measured.

One person uses on average 60 liters of water a day, so if there are five people in a family, 300 liters would be needed for that household every day. If a bucket contains 15 liters, that amounts to twenty trips to the well.

Now, if that distance one way is 50 meters, (omitted) if a fifty-year old housewife who married at the age of twenty were to use the well on average 300 days every year for thirty years until the time her son marries, (omitted) she would have walked 18,000km - in other words, from Tokyo to Kagoshima and back 6.5 times, and moreover, carrying a load of 15kg for half that distance.

(omitted)

If we assume that the time taken to collect water is five minutes each time, on average one hour and forty minutes would be wasted each day. (omitted) Accordingly, in the thirty years between the ages of 20 and 50, this housewife would have spent around three years and seven months collecting water.

Source: National Small-Scale Water Supply Association (1975) *Kani Suido no 20-nen* [Small-scale Water Supply for 20 Years] pp. 289-290

Table S-1 Population with Water Supply Systems and Water Supply Penetration Rate in Japanese Cities, Towns and Villages (2001)

(Unit: 10,000 people)

		Cities	Towns	Villages	Total
Total population		10,036	2,439	243	12,718
Current water supplied population	Mains water service	9,690	1,809	108	11,607
	Small-scale water supply service	9,690	1,809	108	11,607
	(Public utility)	(89)	(40)	(105)	(599)
	(Other)	(22)	(11)	(2)	(35)
	Multi-occupant residential water supply service	42	14	1	57
	Total	9,843	2,239	216	12,298
Penetration rate (%)		98.1	91.8	88.9	96.7

Source: National Small-Scale Water Supply Association website (http://www.kansuikyo.com/f_toukei_13.html)

the perspective of controlling infectious diseases, in 1952 a government subsidy program was launched for small-scale water supply system to be constructed throughout the country. (The subsidy under this program covered one-quarter of the cost of each project.) There was even a dramatic surge of interest among residents of those farming, mountain villages and fishing communities, who had been resigned to never getting a water service. Local groups sprang up around the country, collecting money through "egg money," "water supply savings," and "housewives savings," with the aim of "a simple water supply system for our village as soon as possible." In this way by around the 1970s, Japan had overcome its problems with treating sewage, by collecting it from around the country and there were also cases of local residents volunteering their labor to build their community's small-scale water supply service, in order to save on construction costs. The spread of small-scale water supply system among rural communities also led to the promotion and expansion of water supply services in Japan's urban areas[17].

Through this government subsidy program and the efforts of local residents, by the thirtieth year of the program 13,885 small-scale water supply projects had been completed throughout the country, providing 8.88 million people, or 8.3% of Japan's entire population, with access to water supplies. During this period some places also switched from a small-scale water supply service to a town water service, so the total number of people with access to water supplies exceeded 90 million, or 84.1% of the total population. Even today 6.34 million people in Japan get their water through a small-scale water supply service (see Table S-1). The biggest source of that water is surface water, followed by deep wells, and then shallow wells. Disinfection, rapid filtration and slow filtration are some of the methods used to purify those sources of water, as part of scrupulous management of the service's water quality.

3. Improving Environmental Sanitation in Developing Countries in the Light of Japan's Experience

When it comes to securing safe water supplies and water resources, in developing countries today population growth and poverty combine to produce severe structural problems. These are only exacerbated by generally low levels of rainfall in arid and semi-arid regions, particularly in Africa, West Asia and Central Asia. In this

[17] Ishibashi, Tabun (1975) "Kani Suido ha 'Kokuminkaisuido' no Ninaite, [Private Water-supply System is Bearer of 'Universal Water-system Coverage'],"Kani Suido no 20-nen [Private Water-supply System in 20 Years] Zenkoku Kani Suido Kyokai.

respect the situation in developing countries differs greatly from that of Japan. For that reason, only some aspects of Japan's experience will be applicable to developing countries. We will now examine some of those areas.

3-1 Striking a Balance between Water Supply and Sewage Infrastructure, and Utilization of Appropriate Technologies

Securing safe water supplies is a major challenge facing developing countries, and in order to protect public health and to prevent diseases that arise in unsanitary environments, it is important to build public sanitation facilities, such as water supply and disposal systems and sewage treatment plants. However, when looking to improve its environmental sanitation infrastructure, a country ought to make its decisions based on an overall assessment of its economic strength along with the other issues that demand its attention. In Japan, action was taken based on a balance between its national resources and other pressing issues that it faced at the time.

In particular, since it costs far more to build sewage infrastructure compared to water distribution infrastructure, if a country does not have much financial leeway it may need to consider making use of other less expensive technologies. Japan was able to overcome the slow progress in its sewage infrastructure by using inexpensive and simple means such as small-scale treatment tanks, septic tanks and other sewage treatment tanks; sewage treatment plants that use anaerobic fermentation treatment methods; and individual household combined wastewater treatment tanks. Such relatively inexpensive technologies may also be of use to developing countries. However, for these technologies to function effectively, it is necessary to keep in mind that maintenance and management systems for operating and managing those facilities are equally important.

3-2 Division of Responsibilities between Central and Local Governments

We have already seen how local governments were primarily responsible for the construction of Japan's water and sewage infrastructure, while the national government assisted their efforts by providing a legislative framework and financial subsidies. This method may well be appropriate for developing countries in that it also sits well with the trend to decentralization of government powers. Many aspects of Japan's experience differ from today's developing countries, however, in terms of the scale of water resources and historical development, so the more specific methodologies used in Japan cannot be applied uniformly to developing countries. For a more detailed examination of the proper role of water management policies in developing countries, see JICA Institute for International Cooperation (2002)[18], pp. 39-79.

3-3 Community Responsibility for Provision of Sanitation Facilities

Both central and local governments in developing countries often suffer from severe financial circumstances and shortages of skilled personnel, with the result that the public sector in these countries is unable to provide adequate services. Accordingly, not much can be expected of government efforts alone to address issues of environmental sanitation infrastructure. In order to improve sanitation in these countries, it will be important to get local residents and communities to take the lead in installing small-scale water supply system, wells, and lavatories.

Japan also experienced many examples of residents taking it on themselves to put in their own small-scale water supply system (see Box S-3). The experience of local residents forming community organizations, sharing their knowledge and using the materials available to

[18] Institute for International Cooperation, Japan International Cooperation Agency (2002) *Mizu Bunya Enjo Kenkyukai Hokokusho* [The Study on Development Assistance in Water Sectors], Japan International Cooperation Agency, pp39-79.

them to install small-scale water supply system could serve as a model for developing countries. Equally applicable should be initiatives such as common saving drives and contributions of labor by residents, in order to achieve the goal of a small-scale water supply service for their own community.

Box S-3 Self-help and Mutual Aid in the Community

In Japan, in some cases communities built their own small-scale water supply service through the self-help efforts of their residents, before the government installed mains water services or small-scale water supplies. For example, in a particular village in Ehime Prefecture that is surrounded by steep mountains, by the war's end there were no remaining wells that still functioned, and every day the local women went up and down the slopes of the gorges in order to draw water from what wells were available, spending up to 8,000 hours a year in the process. Following a proposal from its young people, this village formed a "cultural promotion association" with the participation of all households, that drew up a comprehensive community plan for the village for the next thirty years. The plan designated securing potable water supplies as the number one priority. Without any external financial assistance and using natural bamboo from the region and their own knowledge and labor, the local residents built a trial small-scale water supply service. When their work was recognized, a small-scale water supply service was subsequently installed with a subsidy from the local town council.

Until the 1960s "water shortages" arose throughout Japan owing to inadequate mains water supply capacity or to drought conditions. The spirit of mutual aid in the community came to the fore at times like these, when houses in the community that had wells would share water with other residents. It is this spirit of self-help and mutual aid among local residents that constitutes the backdrop to Japan's experience before the government built mains water services.