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FY2017

Report on a Study of International Cooperation in the Water Supply Sector

March 2018
Japan International Corporation of Welfare Services
JICWELS

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Chapter 1 Policy for the FY2017 Study on International Cooperation in the Water Supply Sector

1-1 Details of the Study

1) Studies conducted in the preceding years

Ever since its inception as war reparation toward Japan's Asian neighbors and despite international and domestic criticisms, the Official Development Assistance (ODA) has been evolving to respond to the changing world and its economy. With respect to the water supply sector, initially ODA focused on providing direct assistance for construction of waterworks facilities. But Japan noticed the limited effect of sole assistance for facility construction and maintenance. The country's redirection of focus toward human resource development subsequently proved to be fruitful. In recent years, ODA has also been tasked with strengthening the financial standing of target companies, ensuring proper planning and adequate implementation of phased maintenance and pursuing other activities to consolidate and enhance their business management.

Through the Study Committee on International Cooperation in the Water Supply Sector that was established under this project, Japan's Ministry of Health, Labour and Welfare (MHLW) has been conducting studies and making proposals focused on providing assistance for soft infrastructure development. In the fiscal year 2006, the Review Committee for International Cooperation Projects (Water Supply Sector) issued a report identifying issues to be studied. This report proposed two approaches for conducting necessary activities: (1) developing human resources who will engage in international cooperation and (2) designing a comprehensive assistance program. Since then, proposals have been constantly made to enhance the effectiveness of training programs, improve the way they are organized, and build the capacity of hosting organizations. The following study in the fiscal year 2012 explored desirable assistance in the planning and implementation of water supply projects. It pointed out the need for assistance in the operation and management of water projects for strengthening partner governments' vulnerable fiscal footing and possible infrastructural and financial assistance for phased development and planning according to the reality in target countries and regions. Another study in the fiscal year 2013 mainly compiled and analyzed financial data to propose assistance for better management of water utility business. Examples included measures for increasing service revenue, ideas for reducing costs by streamlining operations, and methods for utilizing external funding. The study in the fiscal year 2014 proposed an analytical method for assessing the business environment in the water utility industry in each country in terms of governance, personnel systems, and financial basis. According to this method, assistance incorporated findings from the assessment of these three conditions. The study in the fiscal year 2015 sorted out international cooperation projects conducted by Japan in the water supply sector and compiled recommendations for better communication and publication of project outcomes both in Japan and overseas.

The study in the last fiscal year kept track of the environment for maintaining international cooperation in the water supply sector and the change in the development goals in the previous decade. After examining how the proposed measures had been implemented, as shown in the diagram below, priority issues for further international cooperation were considered in terms of priority measures, priority regions, securing necessary human resources, and evaluation methods for international cooperation projects. A roadmap was just developed for detailed examination of necessary measures for this fiscal year onward.

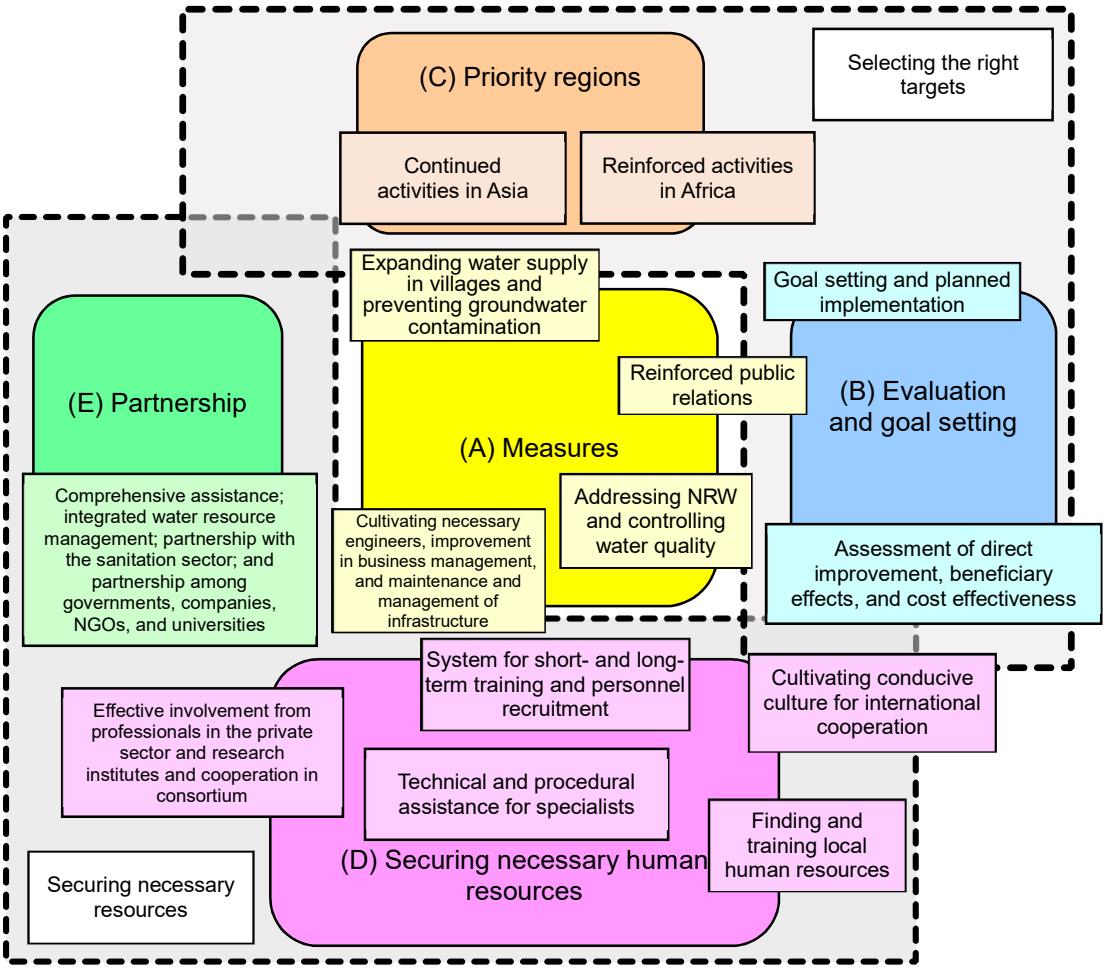


Figure 1.1 Perspectives for discussing international cooperation

Source: The FY2016 Report on a Study on International Cooperation in the Water Supply Sector

2) Background to the theme selected for this study

In February 2015, the ODA Charter was revised to produce a new document called the Development Cooperation Charter by consolidating principles and basic rules for Japan's provision of ODA. The new charter emphasizes the importance of broader cooperation beyond the government-led ODA by involving local communities, private companies, non-governmental organizations (NGOs), and numerous other stakeholders. As one of the priorities for achieving sustainable development, the charter expands the scope of assistance beyond physical infrastructure to comprehensively support developing countries in building their soft infrastructure, such as capacity in operational management, human resources, and legal systems. Accordingly, international cooperation in the water supply sector also needs to be promoted with the Development Cooperation Charter in mind.

In September 2015, the United Nations adopted Sustainable Development Goals (SDGs) to replace Millennium Development Goals (MDGs). This new set of development goals for the international community is more demanding than MDGs in many respects. They set goals for more diverse targets in a wider range of sectors in advanced and developing countries. They emphasize process management guided by discussions rather than by the leadership of the United Nations. In terms of water and sanitation, efficient water use was added as a new target, whereas possible introduction of

monitoring was discussed to take into account the service standards, such as water quality, accessibility, and the time required for accessing potable water. This upgrade is consistent with Japan's conscious international cooperation in the water supply sector to improve water quality and business management as well as to reduce water leakage.

SDGs serve as a guiding principle for future international cooperation in the water supply sector. They also encourage Japan to present the country's achievements in international cooperation and advocate for sustainable development in developing countries, as demonstrated in the Development Cooperation Charter. In ensuring effectiveness of projects aimed at SDGs, it is important not only to assess the current status after the pursuit of MDGs as a baseline for SDGs but also to clarify indicators for monitoring outcomes of further international cooperation.

Accordingly, the study in this fiscal year delves deeper into the issues and possible approaches identified in the study from previous year, namely, ensuring necessary human resources, priority regions, priority measures, and evaluation methods for international cooperation. The study will mainly propose the way Japan should conduct international cooperation in the water supply sector.

3) Direction of this study

In this fiscal year, the Study Committee on International Cooperation in the Water Supply Sector decided to deepen the study of topics sorted out in the study from previous year while keeping in mind SDGs and the Development Cooperation Charter. In doing so, the current situation and identified challenges with respect to priority measures were sorted out by the priority region. The study considered eight priority measures, including those addressing non-revenue water, water quality control, and improvement of business management, as identified in the study from the previous year. Any new issues that are identified and deemed relevant in this study will be additionally examined.

The study from the last year identified Asia and Africa as priority regions. Similarly, the Japanese government also prioritizes assistance to Africa. Cooperation within this continent in the water and sanitation sectors will gain importance considering the high concentration of regions that failed to achieve their development goals. Unfortunately, Japan has a long way to go before it can establish a deep relationship with Africa, similar to the kind it already has with Asia. Access to relevant information is also still quite limited. In this study, therefore, target countries were selected from Africa to gather and compile information to understand regional characteristics while keeping possible comparison with Asia in mind.

Japan's future approach to priority measures will be considered based on findings from this study while taking heed of lessons learned from Japan's international cooperation in the water supply sector in the past.

1-2 The Task Force for the Study

1) Committee structure

This study was conducted over a 1-year period, and the report of findings was drawn up through deliberations undertaken at three meetings held by the Study Evaluation Committee that was established in the fiscal year 2017 for this purpose. The committee members and the schedule of the committee meetings are presented as follows.

(Study committee members)

Hidetoshi Kitawaki	Vice-President and Professor, Toyo University
Hiroki Kusano	Section Chief, Bureau of Waterworks Tokyo Metropolitan Government
○ Shoichi Kunikane	Former Professor of the Institute for Environmental Science, University of Shizuoka
Masaki Sagehashi	Chief Senior Researcher, National Institute of Public Health
Keisuke Sonoda	Section Chief, Saitama City Waterworks Bureau
Daigo Takeda	Subsection Chief, Kitakyushu City Water and Sewer Bureau
Daisuke Nakamura	Subsection Chief, Yokohama Water Works Bureau
Shigeyuki Matsumoto	Deputy Director General, and Group Director for Water Resources Global Environment Department, Japan International Cooperation Agency (JICA)
Ikuo Mitake	Senior Specialist, Japan Water Works Association (JWWA)
Tatsuo Morimoto	Senior Adviser, Japan Water Industries, Inc., General Manager, Pacific Consultants Co., Ltd.

(○: Chairperson)

(Secretariat)

Toru Kajiwara	Director, Office of Global Health Cooperation, Ministry of Health, Labour and Welfare (MHLW)
Tomoyuki Kado	Section Chief, Office of Global Health Cooperation, International Affairs Division, Ministry of Health, Labour and Welfare (MHLW)
Ryota Ushio	Assistant Section Chief, Office of Global Health Cooperation, International Affairs Division, Ministry of Health, Labour and Welfare (MHLW)
Takeo Yamaguchi	Japan International Corporation of Welfare Services (JICWELS)
Saori Arai	Japan International Corporation of Welfare Services (JICWELS)

2) Schedule for committee meetings

The Study Evaluation Committee held meetings in the fiscal year 2017 on the following three dates.

- 1st meeting Tuesday, October 3, 2017
- 2nd meeting Wednesday, January 10, 2018
- 3rd meeting Monday, March 5, 2018

(Domestic research)

- From September 2017 to March 2018

(Overseas research)

- From December 9 to 16, 2017

Chapter 2 Policy Goals for International Cooperation in the Water Supply Sector

2-1 Policy of the Japanese Government

This section summarizes policy goals for considering Japan's doctrine for international cooperation mainly at the government level.

1) Development Cooperation Charter

In 2014, Japan's ODA marked its 60th anniversary. In the following year, the government revised the ODA Charter that had set forth the philosophy and basic principles of ODA. It was renamed as the Development Cooperation Charter. One of the top priorities for this charter, which aims at sustainable development for developing countries, is comprehensive assistance in building not only physical infrastructure but also operational and management capacity, human resources, institutions, and other soft infrastructure. Regarding water supply, the charter set forth a policy to "provide necessary assistance for promoting human-centered development that underpins people's basic livelihood" as a part of the pursuit of "(A) quality growth and poverty eradication." One of the targets was ensuring access to safe water and sanitation. Although the Development Cooperation Charter first mentions deeper partnership in Asia, Africa is mentioned as a next target region that requires coordinated assistance by the government and private sectors.

2) Ministerial Meeting on Strategy relating Infrastructure Export and Economic Cooperation and Infrastructure System Export Strategy

The government has developed the Infrastructure System Export Strategy in a series of Ministerial Meetings on Strategy relating Infrastructure Export and Economic Cooperation since 2013 to establish the Japan brand through broad international partnership in infrastructure development.

In the latest revision of the Development Cooperation Charter in the fiscal year 2017, Japan aimed to establish its leading position in quality infrastructure investment through summits and other international meetings. In the water supply sector, the charter maintains its priorities to (1) organize seminars related to water supply by partner governments, water utilities, and other stakeholders and (2) propose solutions to the challenges they face.

The Ministerial Meeting on Strategy relating Infrastructure Export and Economic Cooperation was held to discuss the export of Japanese infrastructure systems, assistance to secure overseas concessions to energy and mineral resources, and key issues involving Japan's economic cooperation with other countries; all of these aimed at a more strategic and effective implementation. The Infrastructure System Export Strategy formulated in May 2013 aimed at winning orders worth ca. 30 trillion yen in 2020 (ca. 10 trillion yen in 2010) including revenue from business investment. Accordingly, assistance in the water supply sector should also encourage Japanese companies to receive orders.

3) Universal Health Coverage

Universal Health Coverage (UHC) represents affordable services for people to properly build their health, prevent and treat diseases, and restore their physical functions. The aim is to provide necessary

health and medical services for people by eliminating economic constraints. The Basic Design for Peace and Health announced by the Japanese government in September 2015 sets forth the achievement of UHC among other policy goals and basic principles.

One of the basic principles is the contribution to quality growth and poverty eradication through assistance in the health sector. Detailed description also mentions assistance to improve nutrition as well as access to water and sanitation to directly help prevent diseases.[1)]

4) The Tokyo International Conference on African Development

The Tokyo International Conference on African Development (TICAD) is one of the Japanese initiatives that clearly set forth its commitment toward Africa. The TICAD preamble justifies Japan's deeper engagement with Africa in the following manner.

> Still today, Africa struggles with poverty, conflicts, displacement, infectious diseases, and many other serious challenges that are also of great concern to the international community. Japan needs to play a proactive role in the international response to the problems faced by Africa. The continent has great market potential and is rich in resources like rare metals and petroleum that are important for Japan. Assistance for peace to take root in Africa and maintaining friendship with Africa are important for Japan also for ensuring stable import of resources needed for prosperous life and economic growth in our country.

In the Fifth TICAD (TICAD V), held in June 2013, numerous targets were set out for water and sanitation sectors for the following five years. More specifically, Japan committed to contribute to the improvement of access to safe drinking water and sanitary conditions for 10 million people and the human resource development of 1,750 water supply engineers.

The following TICAD VI was held for the first time in Africa (Nairobi, Kenya) in 2016. Nearly 11,000 representatives from African countries, partner countries, international agencies, regional agencies, private sectors, NGOs, and civil societies discussed methods to overcome challenges, including falling resource prices, Ebola outbreak, and violent extremism. The discussion resulted in the declaration of the Nairobi Implementation Plan with three pillars: (1) promoting structural economic transformation through economic diversification and industrialization, (2) promoting resilient health systems for quality of life, and (3) promoting social stability for shared prosperity.[2)] These Japanese initiatives are highly evaluated by African and other countries as well as our development partners.

The upcoming TICAD VII is planned in 2019 in Yokohama with a long history of international cooperation since the dispatch of specialists in 1973. Beginning with Kenya in 1977, the host city has also dispatched specialists to many African countries, such as Egypt, Ghana, Tanzania, Gambia, Senegal, Mali, Zimbabwe, Malawi, and South Africa. Since hosting TICAD IV in 2008, Yokohama has been proactively assisting Africa, for example, by annually hosting many trainees from Africa.

[1)] Basic Design for Peace and Health, MOFA website (www.mofa.go.jp/mofaj/files/000099126.pdf)
[2)] MOFA (http://www.mofa.go.jp/mofaj/area/ticad/index.html)

5) Policy for international cooperation in the water supply sector

In 2004, the Japanese Ministry of Health, Labour and Welfare announced a comprehensive vision that clarifies the priority policy agenda in the water supply sector, along with specific measures, tactics, and processes for addressing them. International cooperation in the water supply sector was clearly mentioned under “international contributions” as one of the five measures for achieving the goals set forth by the Water Supply Vision. This encouraged international activities by water utilities in Japan. The later review in 2008 pointed out the importance of cooperation among water utilities and private companies to recruit and train human resources for assisting developing countries.

The current Water Supply Vision was announced in 2013 to encourage continued international efforts by encouraging the Japanese water supply industry to expand its international operation and by building and retaining the capacity of personnel of water utilities.

Water utilities actively engage in various initiatives, but their policies differ from one municipality to another. For example, Yokohama is making a city-wide effort to become the closest gateway to Africa by forming a federation of diet members for Japanese–African friendship. Meanwhile, TSS Tokyo Water as a supervisory body of the Bureau of Waterworks of the Tokyo Metropolitan Government dispatches personnel to Kenya. The City of Kitakyushu encourages local companies to expand their business in foreign countries, and the possiblity of business expansion for Japanese local companies is the key to decide if Kitakyushu expand into the country or not.

2-2 International Trends

1) International trends in development cooperation

Japan’s international cooperation in the water supply sector initially focused on physical infrastructure development as a part of wartime reparation. More comprehensive assistance in later periods included human resource and institution development. Similarly, the approach to development among the international community has experienced numerous transitions.

In the 1980s, structural adjustment guided development cooperation. In the 1990s, measures against poverty gained weight. In 1999, under the agreement led by the World Bank and International Monetary Fund (IMF), formulation of Poverty Reduction Strategy Papers (PRSPs) was required as conditions for debt relief and funding from the International Development Association (IDA). Donor countries and international agencies were expected to provide assistance in line with these PRSPs.

These efforts toward poverty reduction led the way to Millennium Development Goals (MDGs) as common development goals for the international community, which was based on the United Nations Millennium Declaration adopted in the UN Millennium Summit held in New York in September 2000. The target to “halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation” was already achieved in 2010, as far as drinking water is concerned.

2) Transition from MDGs to SDGs

After reaching the target year of MDGs in 2015, the international community shifted its focus to the post-MDG world. At the UN Summit in September 2015, the 2030 Agenda for Sustainable Development was adopted to set forth SDGs for the international community from 2016 to 2030.

Among the 17 SDGs, Goal 6 is related to water: "Ensure availability and sustainable management of water and sanitation for all." In addition, under Goal 3 "Ensure healthy lives and promote well-being for all at all ages," some targets were set for addressing waterborne infections and water pollution.

2-3 Progress Made on Water and Future Direction

1) Progress made on water in terms of SDGs

Water supply was addressed as one of the targets under MDGs set for the environment. Under SDGs, water supply is addressed in a stand-alone goal. The targets address not only the supply of drinking water and sanitation but also wastewater management, water resource management, and ecosystem conservation. These targets pay attention to both quality and quantity of water supply. Examples include supply of safe and affordable drinking water, efficient water use, sustainable water intake, and ensuring supply of freshwater.

As far as water is concerned, the relevant MDG was reportedly achieved as early as 2010. The target was to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation" from the baseline year of 1990. The achievement mainly owes to the popular use of improved sources of drinking water in rural areas. In Figure 2.1, the darker blue represents a higher share of population using improved sources of drinking water, whereas yellow and orange indicate less common use. The figure demonstrates less use of improved sources of drinking water in African countries in general. Albeit fewer, countries with similar problems are scattered across Oceania, the landlocked parts of Asia, and Central and South America.

As mentioned later, monitoring water supply and sanitation is planned for enhancing the quality of service in line with SDGs. In this aspect, great room for improvement is recognized even in areas with popular use of improved sources of drinking water.

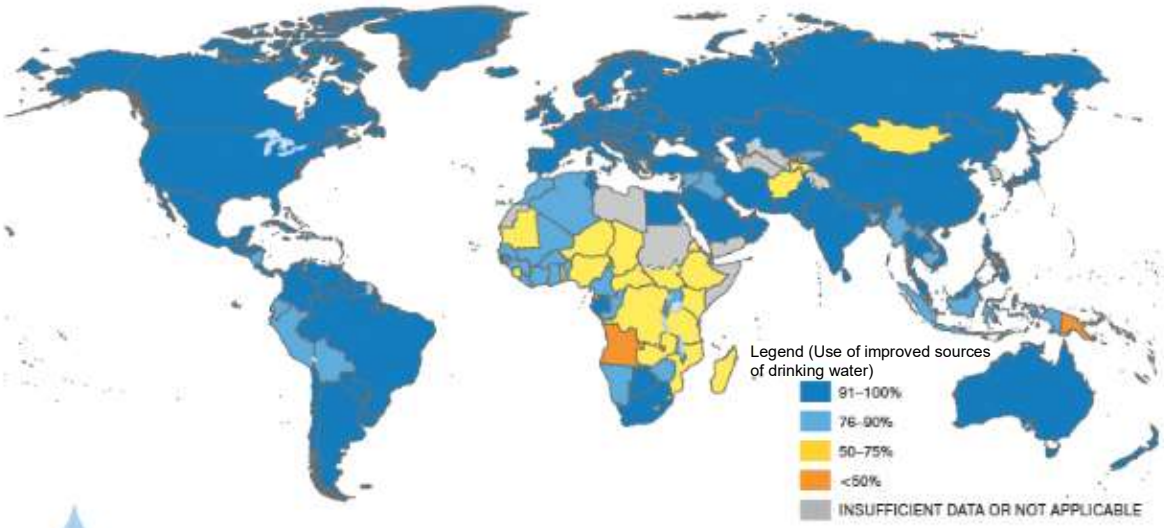


Fig.7 Proportion of the population using improved drinking water sources in 2015

Source: Progress in Sanitation and Drinking Water, 2015 Update and MDG Assessment
WHO/UNICEF Joint Monitoring Program

Figure 2.1 Proportion of the population using improved drinking water sources

2) Indicators and monitoring system for SDG 6 (water and sanitation)

In May 2017, the Inter-Agency and Expert Group on SDG (IAEG-SDG) responsible for leading overall monitoring of SDGs assigned custodians for three different categories of goals according to the discussion on each item and indicator as well as readiness of the available monitoring system. Goal 6 is divided into Targets 6.1, 6.2, 6.a, and 6.b on water supply and sanitation, and Targets 6.3–6.6 on water resource management, water use, and water environment. Monitoring the progress made on the former targets is led by the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (WHO/UNICEF JMP). Since 1990, WHO/UNICEF JMP has been monitoring and reporting progress made on water and sanitation by country, region, and globally. From 2016 onward, the program will continue to monitor progress made on water and sanitation under MDGs by following indicators on water and sanitation under SDGs.

Because Targets 6.1 and 6.2 have already been included in MDGs, they are classified to Tier I for precise monitoring by building on the earlier experience gained by JMP. Targets 6.3–6.6 are classified into Tiers II and III that require baseline surveys by 2018 because of lack of sufficient baseline data.[3)] The breakdown of Goal 6, target indicators, and agencies assigned for their monitoring are presented as follows:

[3)] Tier I: Data are regularly accessible and progress is monitored according to an established method. Tier II: Data are not regularly accessible, although progress is monitored according to an established method. Tier III: No monitoring method has been established.

Table 2.1 SDGs related to water, indicators, and their tier classification

Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all. Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate. Target 6.a: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and program, including water harvesting, desalination, water efficiency, wastewater treatment, and recycling and reuse technologies. Target 6.b: Support and strengthen participation of local communities in improving water and sanitation management.		
Indicators	Tier[4)]	Custodian
6.1.1 Proportion of population using safely managed drinking water services	II	WHO, UNICEF
6.4.1 Change in water-use efficiency over time	III	FAO
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	II	FAO
6.5.1 Degree of integrated water resources management implementation (0–100)	II	UN Environment
6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation	II	UNESCO and UNECE
6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan	I	WHO, UN Environment, and OECD
6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management	I	WHO, UN Environment, and OECD

Source: UN Water, SDG 6 Global Indicators
(http://www.unwater.org/app/uploads/2017/05/SDG6_TABLE_INDICATORS_5-01.png)
UN United Nations Statistics Division
(https://unstats.un.org/sdgs/iaeg-sdgs/tier-classification/)

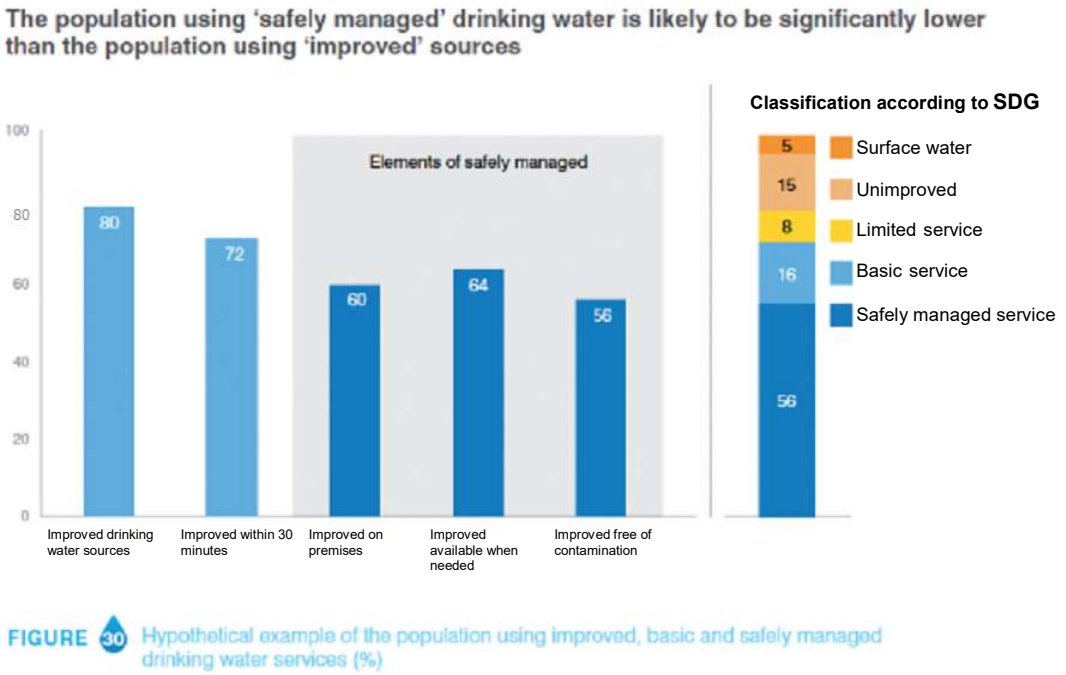
With a close reference to Target 6.1 as the most relevant to waterworks, "improved drinking water sources" were pursued under MDGs. Under SDGs, the expected water quality was redefined as "safe and affordable drinking water." In terms of service quality, "universal and equitable access" was pursued. More specifically, MDG to ensure access to limited water sources in level 3 in Table 2.2 was modified to the corresponding SDG by adding a condition that all people have access to affordable and safely managed water sources.

[4)] The classification in the table is according to a report from December 2017, entitled "Tier Classification for Global SDG Indicators." The classification may be reviewed and revised later.

Table 2.2 Classification of water sources under SDGs

1. Safely managed	Improved water sources (piped water, deep wells, protected dug wells, protected springs, packaged water, and water vendors) located on premises, available when needed, and free from fecal and priority chemical contamination
2. Basic	Improved water sources, as described in 1, except for the required collection time of no more than 30 minutes for a roundtrip, including queuing
3. Limited	Improved water sources, as described in 1, except for the required collection time of more than 30 minutes for a roundtrip, including queuing
4. Unimproved	Unprotected springs and dug wells
5. Surface water/No service	Untreated drinking water taken from rivers, dams, lakes, ponds, mountain streams, and irrigation and other canals

Considering expected improvement in the quality of services according to SDG, some water sources still need improvement even after achieving the corresponding MDG. Figure 2.2 presents the policy for the joint monitoring program by WHO and UNICEF. As shown in this hypothetical example, the percentage of safe water sources free of contamination is calculated based on the smallest figure, i.e., "improved free of contamination (56%)" is the smallest compared with "improved drinking water sources (80%)," "improved within 30 minutes (70%)," "improved on premises (60%)," and "improved available when needed (64%)." Although SDGs are set for all countries, each country additionally sets its national targets according to their local reality.



Source: Figure 30, Safely managed drinking water: thematic report on drinking water 2017

Figure 2.2 Classification and concept of improved water sources that reflect service quality (tentative)

The latest WHO/UNICEF JMP report[5] stating that the progress made with SDG on urban water supply in developing countries will be monitored in terms of access to water on premises or from shared facilities within 30 minutes from home, number of serviced households or people, collection time at facilities, and water quality against the standards. Progress in rural areas will be monitored in terms of distance to protected water sources free of contamination, queuing time for collecting water, seasonal change in the amount of available water, quality of drinking water brought home, and so forth. Considering the difficulty in setting a worldwide standard for affordability and universal access, the evaluation will take into account government subsidies, reduction or exemption of water charge, and other factors when the poor spend >3% of their income for accessing drinking water. Previously, water supplied by cistern trucks or the like and bottled and packaged water were not counted as safe drinking water. But, the latest report set out a policy to count them in as long as necessary quality is ensured. An estimate conducted in this report with selected countries and regions concluded that 5.2 billion people used safe sources of drinking water.

Monitoring will be mainly based on data of water utilities, public waterworks corporations, and municipalities collected from responsible ministries and agencies and household survey conducted as a part of the monitoring program. Of these two sources of information, the latter will be employed as much as possible. The latest monitoring system for SDG 6 on water not necessarily limited to drinking water is presented in Figure 2.3. Monitoring takes place according to the following procedure: 1) an international agency in charge of monitoring requests the respective countries to provide data, 2) data from statistical systems of respective countries are provided to the international agency in charge, 3) the international agency in charge closely examines statistical data in consultation with the respective countries, 4) adjusted data are approved by the respective countries, 5) the international agency in charge submits approved data to the United Nations Statistical Database (UNSD), and 6) UNSD publishes data.

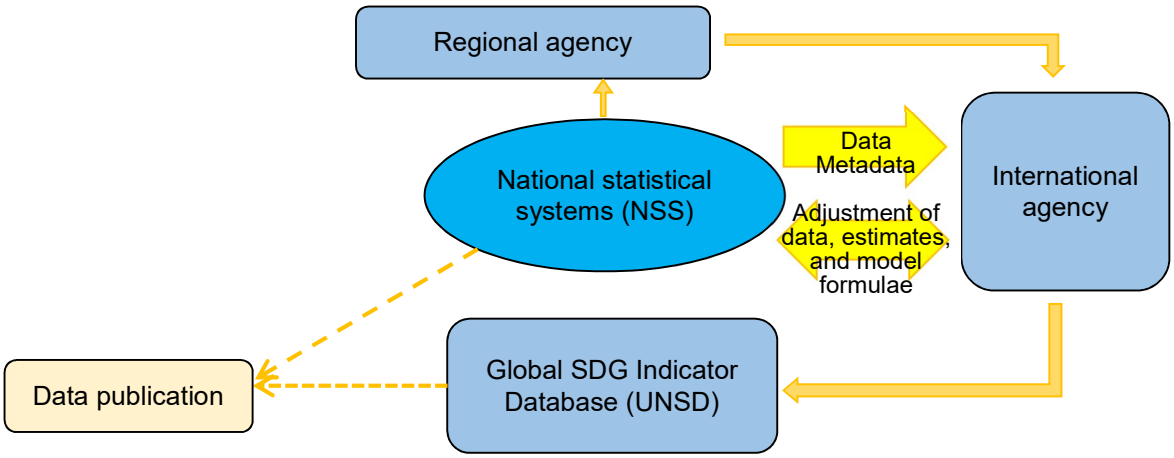


Figure 2.3 Monitoring system for SDG 6 as defined in UN Water[6]

[5] Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), 2017.
[6] "Progress on SDG6 Monitoring" 9th meeting of the OECD Water Governance Initiative, 3-4 July 2017 - Paris, France, https://www.slideshare.net/OECD-GOV/progress-on-the-monitoring-of-sdg-6-water-and-sanitation-for-all-unwater-who

2-4 Trends in Priority Measures Involving Water

This section summarizes international cooperation in the water supply sector by focusing on priority measures identified in the last year, namely, urban water supply, rural water supply, and waterworks operation and human resource management.

1) Measures to address issues involving urban water supply

Urban areas mainly rely on a piped water supply. Most urban water supply is constrained by reduced efficiency of aging facilities whose insufficient capacity cannot keep up with growing cities. Inadequate quality control of the water supplied needs to be addressed. In response, the government of Japan has supported technical assistance projects implemented by JICA mainly to build capacity for maintaining water supply and wastewater facilities, while minimizing non-revenue water and building capacity to control water quality.

Non-revenue water is an important issue that needs to be addressed in many developing countries. In some countries, the proportion of non-revenue water exceeds even 50%. The most common causes are leakage and loss due to water theft. But before these, the amount of distributed water cannot be accurately monitored in many cases because of inadequate instrumentation and management capacity. As such, a combination of facility and equipment maintenance with proper capacity building can sometimes produce comparative achievement as an expensive upgrade of water pipelines.

For improved control of water quality, robust assistance is provided at a policy level because inadequate operation of waterworks is often caused by lack of legal basis for water supply and standards for the quality, although insufficient skills and water treatment chemicals remain main causes. At the international level, in 2005, WHO proposed an approach based on a water safety plan (WSP) by adopting established idea of hazard analysis and critical control point (HACCP) in the food manufacturing industry.[7)] In certain Asian countries and regions, subsidies and development funds can be easily obtained from their governments by developing WSPs.

2) Measures to address issues involving rural water supply

Key measures for rural water supply include wider introduction of supply facilities to areas with difficult access to safe water and an operation and maintenance system development for existing water supply facilities. In countries like India and Bangladesh, measures against arsenic and other inorganic groundwater pollution remain important.

The effectiveness of participatory and community-led rural development is internationally acknowledged based on the idea that improved water supply in villages is desirable for a social reason as compared to improved water supply in urban areas. Accordingly, well construction, small-scale waterworks development, and other facility development are combined with assistance in the building water management system led by residents to ensure sustainable rural water supply. Lessons and findings from rural water supply in Africa have been compiled by JICA into a booklet and are shared among stakeholders.

NGOs, universities, and other research institutes are earnestly trying to tackle problems of arsenic contamination. Technological solutions have already been established to treat and remove target

7) http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/topics/bukyoku/kenkou/suido/suishitsu/07.html

substances. However, difficulty remains in raising awareness on chronic toxicity of these tasteless and odorless substances, which requires reinforced and continued measures toward this end.

3) Measures to address issues involving operation of waterworks

With the recognition of the importance of a sound business base for operation of waterworks, steady measures are being taken by setting priorities for engineer training, better business management, better facility operation and maintenance, and public relations.

Engineer training in water sector has always been a priority for Japan. Since the beginning of cooperation with Asia, training programs have been conducted in combination with construction of training centers with grant aid, technical cooperation project, and human resource development through the soft components in the facility construction project. The study in the fiscal year 2014 compiled historical background of assistance for human resource development, and some good ripple effects have already been reported. One example is a training center in Thailand that now serves as a training center for waterworks engineers in Southeast Asian countries.

As an initiative for improving business management, JICA provided a brochure that is effectively used for fostering executives in 2004. Full recovery of costs involved in the construction and maintenance of facilities is certainly desirable to maintain water supply. But, in many cases, full-cost recovery is difficult when construction cost is also included. Such construction or major upgrade of facilities is usually covered by tax revenue, leaving water charge to cover only operation and maintenance costs. Some countries try to minimize water charge for cultural reasons. But, proper maintenance of waterworks in these countries is difficult because their governments can rarely sustain essential public fund injection.

Operation and maintenance is mainly reinforced through technical cooperation projects conducted by JICA. Still, systematic operation and maintenance with proper technology and record management are yet to take root. Assistance in the construction of rural water supply facilities had been accompanied by soft components in an attempt to reinforce operation and maintenance. Unfortunately, time-consuming process of building necessary frameworks and cultivating human resources had been constrained by limited inputs and the implementation period. Keeping this problem in mind, technical assistance for three to five years was repeated in few phases to ensure continuity of assistance for a sufficient period. Positive outcomes have already been reported in terms of operation and maintenance of rural water supply. For instance, necessary frameworks were reinforced, the role and public nature of associations in-charge were recognized, and target areas were scaled up.[8)]

JICA proactively conducts exhaustive public relations on their overall activities without special focus on the water supply sector. Supposedly, Japanese assistance exerts a strong presence among partner countries. Meanwhile, there is still great room for improvements in public relations with Japanese taxpayers and water users. Support from users needs to be gained by analyzing and communicating advantages expected from the involvement of water utilities in international cooperation.

4) Achievements in water-related cooperation by region

[8)] Summary of evaluation at the completion of Phase 3, Project for Support in National Roll-out of Sustainable Operation and Maintenance Programme in Zambia, and Summary of evaluation at the completion of Phase 2, Rural Water Supply and Sanitation Capacity Development Project in Tanzania

Japan’s water-related cooperation with Asian countries has been focused on urban and provincial water supplies. Meanwhile, rural water supply projects involving digging wells, constructing other public water sources, and installation hand pumps accounted for only 10%–20% of the assistance.

Compared with Asia, rural water supply accounts for a much higher share of the cooperation with Africa, i.e., almost half. In spite of the recent increase in the weight of assistance for rural water supply in Africa, the involvement of Japanese water utilities is still limited. As Japanese assistance to Africa is expected to be reinforced in line with the government goal, consideration must be made for the way in which we should deepen our engagement with Africa.

Chapter 3 Description of the Study

3-1 Selection of Study Targets

The study in the last fiscal year identified and itemized the necessary activities. They are systematically illustrated in Figure 3.1 and itemized in Table 3.1. They are described in detail in the attachment. Among these activities, the study in this fiscal year focused on items that are considered high priority in promoting international cooperation in the immediate future.

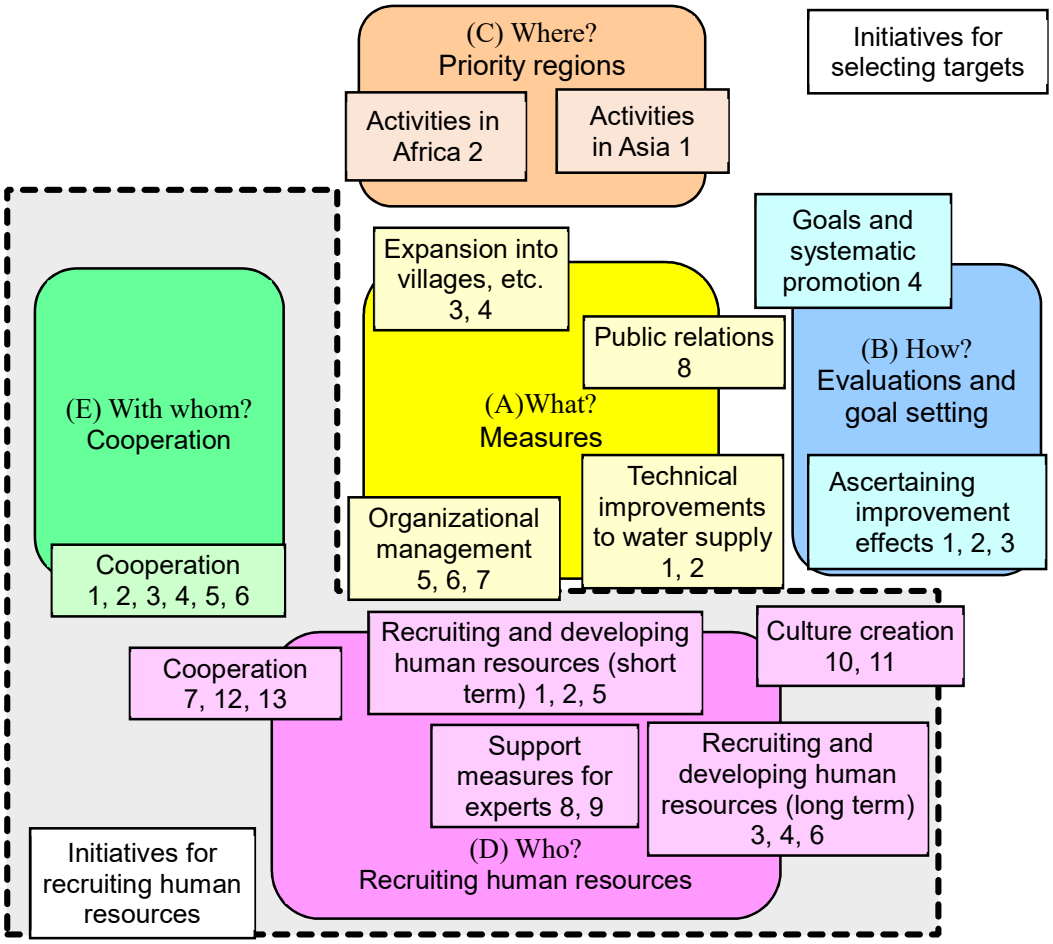


Figure3.1 Overview of necessary activities and subjects identified in the study from the last fiscal year

Table 3.1 Overview of necessary activities identified in the study from the last fiscal year

[Measures: What] Areas of necessary activities

Code	Item	Priorities
A1	Addressing non-revenue water	• Comprehensive assistance beginning with the introduction of leakage detectors and DMA for establishing a reliable system, provision of equipment and materials, and extension to both the management of branching to end users and the precision of meters • Deepening and sharing of knowledge
A2	Water quality control (urban waterworks)	• Feasible water quality standards and an inspection system are developed after analyzing the implementation system and status in line with the legal system of each target country • Consideration of the planned expansion of waterworks to maintain the water quality control in urbanization and integrated technical assistance
A3	Rural water supply	• Consideration of necessary measures according to the reality in each target country after assessing the needs of each village, as well as the coordination and division of roles between rural and urban water supply • Consideration of strategy for Asia with consideration to the improvement of sanitation in villages • Consideration of further activities in Africa on the basis of lessons learned from a wide range of cooperation to date
A4	Measures against inorganic groundwater contamination	• Assessment of the scale and distribution of existing problems • Research for wider introduction and implementation of established treatment methods and other technical measures while taking into account proper application, maintenance, and management
A5	Training of engineers	• Accurate recording of the current state of human resource development • Promotion of human resource development by clarifying the current state before the improvement and visualizing the improvements
A6	Improvement of business management	• Research for the construction and maintenance of waterworks, including the price setting and collection of water charges • Thorough recordkeeping to improve business management • Further implementation of business management improvement combining with the reduce nonrevenue water (NRW) management which has been already applied widely.
A7	Improved operation and maintenance	• Systematic operation and maintenance based on the proper management of technologies and records • Training of executives who can make decisions on facility operations • Consideration of assistance combining facility construction and technical cooperation projects on the basis of the abovementioned activities

Code	Item	Priorities
A8	Public relations	• Consideration of a method for assessing the effects made by public relations activities and new assistance for facilitating quantitative evaluation • Promotion of understanding not only of the direct effects of waterworks development but also the positive spillover to health and sanitation, such as reduced child mortality • Public relations at international conferences, seminars, and forums • Consideration of more effective public relations campaigns at international conferences hosted by Japanese organizations

[Evaluation: How] Assessment of the effect of international cooperation and project selection based on the findings

Code	Item	Priorities
B1	Assessment of direct effects	• Organization of an evaluation system based on practically available data while considering the interlinkage with SDG targets • Management of control data for evaluating direct effects, including the amount and quality of supplied water, duration of supply, adoption rate, management of equipment, and financial statements • Assessment of the current state of data collection • Capacity building for accurate measurements
B2	Assessment of beneficial effects	• Consideration of the monitoring of improved public health and other beneficial effects owing to a combination of decrease in diseases, increased income, and enhanced standards of medical care • Discussion and research on the possibility of effective and adequate data collection at a regional level • Consideration of the quantification and systematic evaluation of beneficial effects
B3	Assessment of cost–benefit performance	• Evaluation of the effectiveness of assistance based on the accurate understanding of the reality in each country • Cost–benefit analysis by considering the project background and the environment
B4	Target setting and systematic implementation	• Enhancing the accuracy of data collection to obtain a correct understanding of the current state • Recommendation for the master plan based on the correct understanding of the current state of each target country

[Evaluation: Where] Priority regions for international cooperation

Code	Item	Priorities
C1	Continuing activities in Asia	• In-depth exploration of solutions for the urban–rural gap
C2	Starting activities in Africa	• Designing of cooperation on the basis of an accurate understanding of local reality • Sorting out information regarding relevance of Japanese experience and implementation framework of each partner country

[Evaluation: Who] Securing human resources for international cooperation

Code	Item	Priorities
D1	Recruitment and training (senior)	• A wide promotion of the senior specialist programs • Consideration of methods for recruiting other specialists
D2	Recruitment and training (in-service water specialists)	• Communication of the importance of their experience for international cooperation • Preparation of foundations in assisting leading specialists to be active in international cooperation • Promotion of human resource development by encouraging senior specialists to work with junior specialists • Building a network of water specialists
D3	Recruitment and training (junior water specialists)	• Development of a recruitment and training system for motivated young or experienced professionals whose workplaces are not limited to water utilities • Public relations on activities by water utilities, JICA, etc. • Building a better system for sharing experiences and promoting exchanges (effective use of SNS, etc.)
D4	Recruitment and training (inexperienced persons)	• Systematic assessment and organization of activities for recruiting future water specialists who are not working in the water supply sector, as well as possible harmonization with these activities • Definition of expertise for meeting the needs of developing countries, and registration and training of specialists according to the definition • Internship programs for providing as many opportunities as possible for students
D5	Retention of local specialists	• Consideration of measures for retaining locally trained specialists • Discussion of practical solutions, such as shortened intervals between project completion and evaluation, as well as assignments, during these intervals
D6	Employment of local specialists in Japan	• After the validation of the significance, any effective measures will be discussed for possible implementation

Code	Item	Priorities
D7	Effective mobilization of talents from private companies	• Consideration of the right combination of talents according to the realities of individual companies in the same manner as that of water utilities • Individually consider the circumstances faced by affiliate companies of water utilities
D8	Support for specialists (logistics)	• Ensure swift start-up and reduced risk by collecting and compiling the background information of each target country and sharing the information among different projects • Without adequate practical experience and skills, trust cannot be built with counterparts in developing countries. In addition to building practical capacity, roleplaying, and other methods can be employed to enhance communication and problem-solving skills
D9	Support for specialists (learning materials)	• Consideration for preparing and improving learning materials • Regular follow-up and information sharing on new trends and technologies
D10	Creation of culture (social awareness)	• Building on public relations activities by JICA to reach wider targets for the effective recruitment of water specialists • Consideration of ways for demonstrating that involvement in international cooperation can also help resolve the challenges faced by Japanese waterworks and cultivate human resources who underpin domestic water supply projects
D11	Creation of culture (responsibilities of water utilities)	• Supporting career development of promising talents by strengthening cross-cutting network among people with experiences in international cooperation • Demonstration of career paths in international development via industry journals, newsletters, etc. • Development of network through training programs
D12	Cooperation in consortium	• In keeping with the diversifying modes of cooperation and menus of assistance offered by JICA, the fledgling partnership with municipalities and private companies should be further encouraged in grant aid, loan assistance, and technical cooperation
D13	Effective mobilization of universities and research institutes	• Hosting international students, researchers, and practitioners at universities and research institutes to help develop human resources and build their reserve • Implementation of projects within the existing framework • Upgrading of programs for hosting international students (JICA)

[Evaluation: With Whom] Partnership with other stakeholders of international cooperation

Code	Item	Priorities
E1	Approach for comprehensive assistance	• Partnership with the health, sanitation, and regional development sectors • Research and practice of effective methods for gaining desired outcomes
E2	Integrated water resource management	• Encouraging the water supply industry to participate in JICA's Executive Forums for Enhancing Sustainability of Urban Water Service in Asian Region and other exchange activities • Organization of information for water utilities in general • Broaden communications and exchanges with relevant ministries and agencies • Activities to deepen involvement with state affairs • Expanding the scope of activities by the liaison conference of stakeholders involved in international cooperation in the water supply sector
E3	Coordination with sanitation	• Development of waterworks in coordination with that of sewerage • Activities for strategically exporting water and sanitation (waterworks and sewerage) and other urban infrastructure technologies in a packaged assistance
E4	Public–private partnership	• Exchange of opinions oriented toward learning from cases overseas
E5	Partnership with NGOs	• Exploration of partnership including budgetary provision
E6	Partnership with universities	• Exploration of ways for maintaining and further upgrading the network with the effective application of existing systems

Table 3.2 Activities identified in the study from previous year and their priorities

Classification	Code	Item	Priorities	Remarks
Measures What	A1	Addressing non-revenue water	B	The menu was prepared on the basis of Japan's experience in water supply. All of them are important, but further research must be made with public–private partnership and other activities without sufficient experience.
	A2	Water quality control (urban waterworks)	B	
	A3	Rural water supply	B	
	A4	Measures against inorganic groundwater contamination	B	
	A5	Training of engineers	B	
	A6	Improvement of business management	B	
	A7	Improved operation and maintenance	B	
	A8	Public relations	B	
Evaluation How	B1	Assessment of direct effects	A	Proper information collection needs to be considered in line with SDGs.
	B2	Assessment of beneficial effects		
	B3	Assessment of cost–benefit performance		
	B4	Target setting and systematic implementation		
Regions Where	C1	Continuing activities in Asia		First, begin with assessing the current situation.
	C2	Starting activities in Africa	C	
Human resources Who	D1	Recruitment and training (senior)	D	Recruitment of necessary human resources is an urgent task. Anything that brings quick results should be performed immediately. It is also important to cultivate a conducive environment in the long term.
	D2	Recruitment and training (in-service water specialists)	D	
	D3	Recruitment and training (junior water specialists)	D	
	D4	Recruitment and training (inexperienced persons)		
	D5	Retention of local specialists		
	D6	Employment of local specialists in Japan		
	D7	Effective mobilization of talents from private companies		
	D8	Support for specialists (logistics)		
	D9	Support for specialists (learning materials)		
	D10	Creation of culture (social awareness)	D	
	D11	Creation of culture (responsibilities of water utilities)	D	
	D12	Cooperation in consortium		
	D13	Effective mobilization of universities and research institutes		
Partnership with Whom	E1	Approach for comprehensive assistance		These items should always be kept in mind in conducting future activities.
	E2	Integrated water resource management		

Classification	Code	Item	Priorities	Remarks
	E3	Coordination with sanitation		
	E4	Public–private partnership		
	E5	Partnership with NGOs		
	E6	Partnership with universities		

* "Priorities" in the table represent priority measures, whereas symbols A to D represent the following aspects:
  A: Assessment of conditions in each country by keeping in mind the indicators for SDGs
  B: Evaluation of needs and activities in the water and sanitation sectors
  C: Expansion to regions with weak ties
  D: Recruitment and training of human resources over the long term

Focus will be placed on A, B, and C among measures in the table that were given relatively high priority in the study from the previous year. More specifically, target countries are selected while keeping aspect C in mind to conduct field surveys with regard to aspects A and B.

3-2 Details of the Study

The study is conducted for the assessment of conditions in each country by keeping in mind the indicators for SDGs (A) and the evaluation of needs and activities in the water and sanitation sectors (B). Regarding the expansion to regions with weak ties (C), implications from the study on aspects A and B will be compiled.

A: Assessment of conditions in each country by keeping in mind the indicators for SDGs

Compared with the international contributions of other countries, Japan makes a significant contribution in the water supply sector. The understanding of this fact should be promoted. It is important to demonstrate how specific activities contribute to the achievement of policy goals for Japan's international cooperation.

Therefore, the quantitative demonstration of the outcomes of international cooperation according to the SDG indicators is expected to grow in importance in the future. Presently, discussion is underway to select indicators by considering the ease of data collection and the reliability of data. Unfortunately, coordination is proving to be difficult. Accordingly, by taking the opportunity of this study, information was collected for each indicator to measure the progress in international cooperation in the water supply sector.

- The study examines the framework adopted by the agency in charge, the survey projects being conducted, and the reporting system in the target country. For instance, to calculate the proportion of population using safely managed drinking water services corresponding to SDG 6.1, it is advisable to assess whether any organization in the target country can handle the task, whether WHO or UNICEF has assigned any organization to pursue tasks, or whether a consultant needs to be employed.
- The collection of basic data is essential for calculating the progress made with each goal. For example, take the calculation of the proportion of population using safely managed drinking water services corresponding to SDG 6.1. As far as urban water supply is concerned, water sources must be individually examined in terms of numerous factors. They include "the number

of households with water supply on premise or shared facilities that can be accessed within 30 minutes," "the number of serviced households or people," "collection time at water supply facilities," and "achievement of water quality standards (i.e., water quality data taken multiple times, serviced range, service capacity, etc.)" The system for collecting these data needs to be understood.

- The study needs to identify when and how exactly these data were collected, whether the method is clear and reproducible, whether the data are regularly updated, which organization conducted the necessary survey, and so on. Sufficiently reliable information that can answer these questions can facilitate not only the measurement of the effects of implemented projects but also the design of future projects.

B: Evaluation of needs and activities in the water and sanitation sectors

As priority measures, the study in the previous year identified "addressing non-revenue water," "water quality control (urban waterworks)," "rural water supply," "measures against inorganic groundwater contamination," "training of engineers," "improvement of business management," "improved operation and maintenance," "public relations," etc. Findings from Laos were also organized.

The implementation of these measures requires the proper understanding of the waterworks administration of each partner government, necessary assistance for building an administrative system to bolster administrative capacity, and management capacity of private operators.

JICA's other initiatives were compiled on the basis of published materials for a comparison in terms of these measures. A field survey was conducted in Rwanda to assess the current status of these measures, the current status of the water supply business in general, and the challenges faced, as well as to compile any differences with Asian countries.

3-3 Target of the Study

The target of the study was selected among African countries while keeping in mind aspect C: "Expansion to regions with weak ties."

C: Expansion to regions with weak ties

In the study from the previous year, the track records of international cooperation in the water supply sector for the past 10 years were compiled. That study found out that approximately half of technical cooperation and grand aid targeted Africa, whereas loan assistance mainly targeted Asia.

Notably, according to the recommendation from the study conducted in fiscal year 2006, the adopted policy focused on Asia at that time while trying to build toeholds in other regions. Accordingly, field surveys for international cooperation have been conducted exclusively in Asian countries.

Japan is clearly unfamiliar with Africa compared with Asian countries, some of which have a long history of cooperation with Japan. Currently, encouraged by political stability, Japan has begun to pursue cooperation with Africa. Proactive cooperation in the water supply sector should be sought by first gaining an understanding of local realities.

An African country was targeted for study in this fiscal year to make a baseline for comparison with Cambodia and Laos, which were surveyed in the previous year and the one prior. The comparison was intended to identify notable differences in Japan's cooperation in the water supply sector with unfamiliar Africa and familiar Asia.

Chapter 4 Field Survey in Rwanda

4-1 Selection of a Country to Be Surveyed

1) Process of past surveys (as of last year) and selecting a subject country for this survey

As summarized in Chapter 2, when results of international cooperation activities in the water sector for the past 10 years were reviewed in terms of the number of projects that have been conducted, approximately half of these projects were applied to the African region for technical cooperation and grant aid projects, and loan assistance projects were mainly provided to the Asian region.

On the contrary, the proposal at the time of implementation in the FY2006 had the policy that was "to focus on Asia at that time while trying to build toeholds in other regions," and the past field surveys have all been conducted in Asian countries. For Japan, although the African region is an unknown area historically and geographically compared with the Asian region, it is considered to be meaningful for the water sector to understand local information under the present circumstances such that assistance is being promoted as a national policy in a follow-up to independence from European and American colonial rule, stabilized political situation, etc.

Therefore, this study briefly summarizes basic information of the African region first and then, such information is to be examined to select a country that would be effective in considering international cooperation activities of Japan.

2) Basic information of the African region

The history of Africa has been largely affected by its relation with European history. While the northern African region at the opposite side of Europe across the Mediterranean Sea mainly includes Arabic Caucasian people, the Sub-Saharan region to the south of the Sahara Desert has developed its own civilization and language. Toward the end of the 15th century, from the time when the Age of Discovery arrived in Europe and people from European countries, including Portuguese, started sailing down the west coast, full-scale exchanges between African and European countries expanded to the Sub-Saharan region. However, during the period from approximately the early 16th century to the late 18th century, it was the time when the securement of labor by European countries to develop the New Continents, the so-called Slave Trade, became the main purpose of this relation.

From approximately the 1880s, colonization of the African region was advanced by the European powers of imperialism and their colonial rule was continued after the World War II. However, momentum for independence of African countries was heightened after the War ended, which resulted in independence of African countries after 1960, which was called the "year of Africa." This started with the independence of Libya from Italy in 1951 and of Tunisia and Morocco from France in 1956.

Development of Africa after its independence was delayed compared with that of Asia and Latin America because of the ethnic confrontation arising from the takeover of boarder lines designated by European countries, spread of HIV/AIDS, etc. However, after the 1980s, each country promoted political democratization and economic liberalization, which were coincident with the price hike of mine products in the 2000s, resulting in unprecedented economic growth being achieved in the Sub-Sahara Africa, such as a real GDP rate of 5% or more on an average that was continued until 2014.

Table 4.1 organizes latest social economic indicators in the African region. For comparison, indicators in the Asian region and the world are also listed. Further, the population has been also

growing rapidly in recent years. The population of Africa as of 2017 was 1,256.26 million persons, which means that one in approximately six people in the world is an African.[9)]

Table 4.1 Main social economic indicators in Africa and Asia

	Africa		Asia				World
	Entire region	Sub-Sahara out of it	Entire region	East Asia out of it	Southeast Asia out of it	South Asia out of it	
Urbanization rate (%)[10)]	40%		48%				
Annual average population growth rate (%) (from 2010 to 2015)[9)]	2.6%	2.7%	1.0%				1.2%
Under 5 mortality rate (per 1000 persons) (from 2010 to 2015)[9)]	-	95 persons	38 persons				48 persons
Average life (from 2010 to 2015)[9)]	-	58 years	72 years				71 years
GNI (per person) (USD) (2016)[11)]	-	1,516	-	9,858		1,611	10,316
Rate of access to safe drinking water (2015)	-	68%	-	96%	90%	93%	91%
Rate of access to fundamental sanitation (2015)	-	30%	-	77%	72%	47%	68%

3) Examination of subject to be surveyed

The North African region is relatively developed and assistance by Japan is also provided to Sub-Saharan Africa; therefore, the survey subject is to be selected from the Sub-Saharan region.

The numbers of grant aid projects that have been conducted over the past decade broken down by country became eight for Ethiopia and six each for Kenya and Tanzania. In addition, numbers of technical cooperation projects are six for Kenia and four for Sudan, showing that countries in the eastern African region are main targets for assistance.

Table 4.2 summarizes details of technical cooperation projects. The name of each project reveals that implementation and operation of rural water supply, improvement of water supply and sanitation as well as human resource development for water works have been mainly conducted and non-revenue water management and technical cooperation to water supply corporations in urban cities have also been conducted recently.

Table 4.2 List of technical cooperation projects in previous years
(projects conducted from the FY2006 onward)

Country name	Project name	Cooperation period
Uganda	The Project for Operation & Maintenance for Rural Water Supply and Improved Hygiene and Sanitation	Jul. 2015–Aug. 2019

9) World population, 2017 (https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_Wallchart.pdf)
10) World Urbanization Prospects, The 2014 Revision, United Nation (https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf).
11) Gross national income per capita 2016, Atlas method and PPP, http://databank.worldbank.org/data/download/GNIPC.pdf

Country name	Project name	Cooperation period
Ethiopia	The Water Sector Capacity Development in Southern Nations, Nationalities and People's Region	Dec. 2007–Dec. 2011
	The Ethiopian Water Technology Center Project Phase-3	Jan. 2009–Nov. 2013
	The Project for Rural Water Supply, Sanitation and Livelihood Improvement through Dissemination of Rope Pumps for Drinking Water	Feb. 2013–Dec. 2016
Kenya	The Project for Management of Non-Revenue Water in Kenya (Nairobi and neighboring provisional cities)	Nov. 2009–Sept. 2013
Zambia	Sustainable Operation and Maintenance Project for Rural Water Supply (SOMAP) Phase 2	Sept. 2007–Sept. 2010
	The Project for Support in National Roll-out of Sustainable Operation and Maintenance Programme (SOMAP 3)	Sept. 2011–Mar. 2017
Sierra Leone	Establishment of Water Supply Management System in Kambia District	Dec. 2006–Sept. 2008
Sudan	Human Resources Development for Water Supply (Khatroum)	Apr. 2008–Mar. 2011
	The Project for Management Capacity Enhancement of Southern Sudan Urban Water Corporation	Nov. 2010–Nov. 2013
	Human Resources Development for Water Supply in Phase 2 (Khatroum, Sennar state, White Nail state)	Nov. 2011–Sept. 2015
	Project for Strengthening Capacity of Institutional Management, Operation and Maintenance in State Water Corporations	Feb. 2016–Jan. 2020
Senegal	Safe Water and Support for Community Activities Phase 2	Jan. 2006–Mar. 2010
Tanzania	Rural Water Supply and Sanitation Capacity Development Project	Jun. 2007–Aug. 2010
	The Technical Cooperation Project for Enhancement of Water Supply Management of Zanzibar Water Authority	Sept. 2007–Dec. 2010
	Rural Water Supply and Sanitation Capacity Development Project	Sept. 2007–Jul. 2010
	Rural Water Supply and Sanitation Capacity Development Project Phase 2	Sept. 2011–Aug. 2014
	The Technical Cooperation Project for Enhancement of Water Supply Management of Zanzibar Water Authority Phase 2	Nov. 2011–Oct. 2015
	Groundwater Development and Management Capacity Development Project in Tanzania	Mar. 2012–Mar. 2016
Nigeria	Federal Capital Territory Reduction of Non-Revenue Water Project	Oct. 2014–Mar. 2018
Burkina Faso	Project for enhancement of water supply infrastructure management and hygiene and sanitation in the Regions of Central Plateau	Jun. 2009–Jun. 2013
	Project for enhancement of water supply facilities management and hygiene and sanitation in rural areas Phase 2	Sept. 2015–Sept. 2018
Madagascar	Project for the Improvement of Rural Water Management and Hygiene Practice in Atsimo Andrefena Region	Sept. 2008–Mar. 2013
Malawi	The Project for Enhancement of Operation and Maintenance for Rural Water Supply	Jul. 2011–Jul. 2015
Mozambique	Sustainable Water Supply, Sanitation and Hygiene Promotion in Zambezia Province	Feb. 2007–Aug. 2011
	The Project on Promoting Sustainability in Rural Water Supply, Hygiene and Sanitation in Niassa Province in Republic of Mozambique	Jan. 2013–Feb. 2017
Rwanda	Project for Strengthening Operation and Maintenance of Rural Water Supply Systems (dispatch of experts)	Jun. 2006–Nov. 2006
	Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Apr. 2015–Dec. 2019
	Project for Strengthening Non-Revenue Water Control in Kigali City Water Network	Jul. 2016–Jun. 2019
South Sudan	The Project for Management Capacity Enhancement of South Sudan Urban Water Corporation Phase 2	Jan. 2016–Dec. 2019

Based on previous results summarized thus far, Ethiopia, Kenya, Zambia, Sudan, Tanzania, Uganda, Malawi, Rwanda, Cameroon, Niger, Nigeria, and Burkina Faso became targets for further examination as counties having results of grant aid projects and technical cooperation projects. For narrowing, basic information of the countries and information such as project development plans were organized in Table 4.3, and the possibility of further examination was assessed in three stages. GNI and Human Development Index (HDI) referred to in basic data in the Table were extracted from World Bank Data[12] and UNDP Human Development Report.[13]

After comparison and consideration of such information, Sudan and Rwanda were selected as countries that have results and definitions in the assistance policy, with relatively stable security

[12] http://data.worldbank.org/indicator/NY.GNP.PCAP.CD
[13] http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf

situation. However, considering special circumstances in Sudan requiring a few days for foreign people to obtain permit for domestic movement and ongoing technical cooperation projects for urban and rural water supply in Rwanda, it was decided to select Rwanda as a subject country for the survey in this year.

Table 4.3 Basic data and summary of the present conditions in the water sector of candidate countries to be surveyed in the African region

Basic data	Project development plans	Questionnaire about water sector (Questionnaire results from participants of training by issue)	Security situation and matters related to municipality	Necessity of further examination
<Ethiopia> GNI: 590 USD (2015) HDI: 174th place (among countries that are compared in this Table, 10th/12 place) Economic Growth Rate: 11.2% (average of 2004–2010) Basic assistance policy in the water sector: To conduct cooperation activities for water supply projects in rural areas and for human resource development and underground survey in the water sector as well as to support improvement in water supply capacity, operation, and maintenance.	Development issue 1-2: Facility development by grant aid cooperation and human resource development by technical cooperation, dispatch of Water Security Action Team (10 persons), and support by NGO and grass-root level grant aid projects are included in the plan as "Improvement of access to safe water and operation and maintenance" (June 2013).	Governance: Water Act (2005), Water Standard (2008), and the national strategy (established in 2014) exist. Organization similar to the Water Works Association exists. Personnel affairs: No clear selection standard exists. Human resources development program is available. Financial basis: Independent from a general account. Revision of charges is possible. Private financing is available.	The level of attention attraction is 1 or 2, except boarder areas including Somalia and Eritrea.	○ Neighboring countries are unstable and it is necessary to pay attention to the security situation. Currently, no project is being conducted; however, a groundwater project is to be implemented from June 2017.
<Kenya> GNI: 1,340 USD (2015) HDI: 146th place (2nd/12) The number of Japanese companies operating is the second largest in the Sub-Sahara (32 companies as of 2009) Basic assistance policy in the water sector: No special note. (It is stated that appropriate planning, development, improvement as well as operation and maintenance of urban infrastructures are to be supported as economic infrastructure development.)	Development issue 3-1: It is defined "to enforce the capacity of water resource management and to improve the rate and volume of water supply in urban and rural areas based on water resource preservation, water supply, and national water resources master plan 2030"; support to SMEs, and training by issue and dispatch of volunteers projects are included in addition to grant aid projects (April 2016).	No participation result.	The level of attention attraction in the southern half including the capital is 1 or 2. • Bureau of Waterworks Tokyo has been participating in the Project for Strengthening Capacity in Non-Revenue Water Reduction (from September 2016 to September 2021).	○ Despite results, there is no clear definition in the assistance policy. Advisors and the Non-Revenue Water Project are being conducted.
<Zambia> GNI: 1,490 USD (2015) HDI: 139th place (1st/12) GDP growth rate of 6%–7% has been maintained since 2004. The basic assistance policy in the water sector: No special note.	Development issue: As one of the programs to develop healthy and high-quality human resources for the next generation, "construction of water supply and sanitation facilities and enhancement of operation and maintenance as well as management capacity" is defined, and grant aid, technical cooperation, training by issue, and grass-root level technical cooperation projects are planned (April 2016).	Governance: Water Act (1997), Water Standard (1997), and the National Strategy (established in 1994) exist. Organization similar to the Water Works Association exists. Personnel affairs: A clear selection standard exists. The human resources development program is available/not available. Financial basis: Independent from a general accounting. Revision of charges is possible/not possible. Private financing is available/not available. (Depending on the answerer) * A semi-government company operates water supply. Water pollution caused by heavy metal is occurring.	The level of attention attraction is 1 in most areas. It is level 2 only in areas around the borders with Democratic Republic of Congo and with Angola. • Yokohama Water has been participating in the Project for Strengthening Capacity of Urban Water Supply Infrastructure (from February 2017 to November 2018).	○ Despite results, there is no clear definition in the assistance policy.
<Sudan> GNI: 1,920 USD (2015) HDI: 165th place (8th/12) GDP growth rate of 6%–7% has been maintained since 2004. Basic assistance policy in the water sector: It is defined to contribute to the achievement of MDGs by continuing to provide support in the health, water, and sanitation sector, which have results as a part of basic livelihood assistance sector (2012).	Development issue 2-2: It is defined "to promote evaluation and survey of water revenue by watershed area for sustainable water use based on the scientific basis as enhancement of water and sanitation facilities and operation and maintenance capacity." In addition to the grant aid, technical cooperation, and training by issue, emergency assistance through UN agencies has also been conducted (April 2016).	Governance: Water Act (1999), Water Standard, and the National Strategy (2011–2016) exist. There is no organization similar to the Water Works Association. Personnel affairs: A clear selection standard exists. The human resources development program is available. Financial basis: Independent accounting system. Revision of charges is possible. Private financing is not available.	The levels of attention attraction are 1 in the northern half, including the capital, and 3 in the southern half. • Project for Strengthening Capacity of Institutional Management, Operation and Maintenance in State Water Corporations (from February 2016 to January 2020) is being conducted.	⊙ There are results and definition in the assistance policy. Further, there are also many participation results in the training by issue. A technical cooperation project is being conducted.

Basic data	Project development plans	Questionnaire about water sector (Questionnaire results from participants of training by issue)	Security situation and matters related to municipality	Necessity of further examination
<Tanzania> GNI: 920 USD (2015) HDI: 151st place (3rd/12) The number of Japanese companies operating is the third largest in the Sub-Sahara region (19 companies, 2010). The basic assistance policy in the water sector: It is defined to assist infrastructure building in the water supply and water resources management sector, paying attention to project creation utilizing technological advantage of Japan as infrastructure development to support economic growth and poverty reduction (2012).	Development objective 3-2: In the "improvement of administrative service," enforcement of rural water supply program as well as urban water supply, water resources management, etc. are defined as the "water supply enforcement program." loan assistance, grant aid, technical cooperation, individual experts, training by issue, and glass-roots level grant aid projects have been conducted and planned (September 2017).	Governance: Water Act (2006), Water Standard (governed by WHO), and the National Strategy (established in 2005) exist. There is no organization similar to the Water Works Association. Personnel affairs: The clear selection standard exists. The human resources development program is available. Financial basis: A semi-independent accounting system. Independent from general accounting. Possibility of revision of charges is unknown. Private financing is not available.	In the capital and most areas, no warning or level 1. Only in areas around the border with Burundi, the level is 3. • Yokohama Water has been participating in the Preparatory Survey on Zanzibar Urban Water Distribution Facilities Improvement Project (project creation, loan assistance) (from February 2016 to February 2017).	○ There are results and definition in the assistance policy. Further, there are also participation results in both projects of rural and urban water supply as well as training by issue.
<Uganda> GNI: 700 USD (2015) HDI: 163rd place (7th/12) Basic assistance policy in the water sector: For living environment development (health and water supply), efforts to improve the rural water supply rate through building water supply facilities and enhancing the water management system have been defined (2012).	Development issue 3-2: As "water supply for living," technical cooperation, dispatch of the Water Security Action Team, training by issue, and grass-root level grant aid projects have been conducted and planned under the rural water supply development program (April 2016).	No participation result in 2015 and 2016.	Level 1 in most of areas including the capital. Levels 2 and 3 in areas around the borders of South Sudan and Democratic Republic of the Congo.	△ Although results are limited, the water sector is defined in the assistance policy. A technical project is being conducted.
<Malawi> GNI: 340 USD (2015) HDI: 170th place (9th/12) Basic assistance policy in the water sector: For "improvement of basic social service" in the water sector, it is stated that based on the situation where depletion of water resources is a concerned due to overdevelopment that has advanced in recent years, sustainable water use and management is to be promoted by establishing a water resources development strategy as well as improvement of the stable water supply rate is to be supported by utilizing the existing water supply facilities through repair, and operation and maintenance system enhancement of such facilities (2012).	Development issue: As "improvement of access to and quality of basic service," technical cooperation, dispatch of experts (water resources advisors), dispatch of Japan Overseas Cooperation Volunteers in the water sector, and training by issue have been conducted and planned under the safe and stable water supply program (April 2016).	Governance: Water Act (2006), Water Standard (governed by the WHO), and the National Strategy (established in 2005) exist. There is no organization similar to the Water Works Association. Personnel affairs: A clear selection standard exists. A human resources development program is available. Financial basis: A semi-independent accounting system that is independent from general accounting. The possibility of revision of charges is unknown. Private financing is not available.	The level of warning is 1 in the entire land.	△ Although results are limited, the water sector is defined in the assistance policy. A groundwater project is to be implemented from July 2017.
<Rwanda> GNI: 700 USD (2015) HDI: 159th place (6th/12) Basic assistance policy in the water sector: For "improvement of social service (safe water supply)," supporting water supply projects in a comprehensive manner, including enhancement of the operation and maintenance system (which secures access to safe water for all the nations, in particular, for the eastern district where the water supply rate is low) and improving social development infrastructure have been defined (2012).	Development issue: Grant aid, technical cooperation, grass-root level grant aid, dispatch of Japan Overseas Cooperation Volunteers in the water sector, and training by issue have been conducted and planned as "safety water supply" (April 2016).	No participation result	The level of warning is 1 in the entire land. • Yokohama Water has been participating in the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network (from July 2016 to June 2019).	⊙ (Selected) There are results and definition in the assistance policy. Further, projects for rural and capital water supply are being conducted.
<Cameroon> GNI: 1,320 USD (2015) HDI: 153rd place (5th/12) Basic assistance policy in the water sector: No special note.	Water and sanitary project was conducted by grass-root level grant aid as a project not included in any specific development issue (April 2016).	No participation result (*Francophone)	In most areas, including the capital, the level of warning is 1. It is 2–4 in areas around the borders.	△ Despite results, there is no definition in the assistance policy and the project development plan.

Basic data	Project development plans	Questionnaire about water sector (Questionnaire results from participants of training by issue)	Security situation and matters related to municipality	Necessity of further examination
<Niger> GNI: 390 USD (2015) HDI: 187th place (12th/12) Basic assistance policy in the water sector: No special note.	Development issue: For “agriculture and development,” “improvement of access to safe water” and “enhancement of farmers’ capacity through utilization of valuable water resources” are defined. Grant aid and training by issue have been conducted and planned (April 2016).	No participation result (*Francophone)	The levels of warning are 2 only in the capital, 3 in the southern region, and 4 in the northern region.	× There is no definition in the assistance policy, and the security is unstable.
<Nigeria> GNI: 2,820 USD (2015) HDI: 152nd place (4th/12) Basic assistant policy in the water sector: In the “promotion of social development mainly for urban cities,” it has been defined that contribution for improvement of living and business environment is to be made through facility development for the improvement of undeveloped waterworks and water supply as well as technical transfer (2012).	Development issue: The water resources management program in the “water resources” and improvement of basic service of the federal capital territory in the “improvement of urban function” are defined. Technical cooperation and local domestic training projects have been conducted and planned (April 2016).	Governance: Water Act (2000, not enacted yet), Water Standard (2013), and the National Strategy (reviewed in 2014) exist. Organization similar to the Water Works Association exists. Personnel affairs: A clear selection standard exists/does not exist. The human resources development program is available/no specific definition. Financial basis: Independent accounting system depending on the entity. Non-independent from a general accounting. Revision of charges is possible. Private financing is available/not available.	Level 2 in approximately half of the areas including the capital. Levels 3 and 4 in the northern and notheast regions. • Yokohama Water has conducted the Federal Capital Territory Reduction of Non-Revenue Water Project (from October 2014 to March 2018).	△ There are results and clear definition in the assistance policy; however, security is unstable.
<Burkina Faso> GNI: 640 USD (2015) HDI: 185th place (11th/12) Basic assistance policy in the water sector: No special note.	Water and sanitary project by grant aid, technical cooperation, and grass-root level grant aid was conducted as a project not included in any specific development issue (April 2016).	No participation result (*Francophone)	The attention attraction level in most areas including the capital is 1. In border areas of Niger and Mali, levels are 2–4.	△ Despite results, there is no definition in the assistance policy. It is difficult to secure human resources on the Japanese side because it is a French-speaking country.

4-2 Summarized Information on the Country Visited (Rwanda)

1) Outline of the target country[14)]

1. Geographical features and climate

The Republic of Rwanda is a landlocked highland country in East Africa, which is surrounded by Uganda (north), Tanzania (east), Burundi (south), and the Democratic Republic of the Congo (west). Since most part of the country is a highland, the climate is comfortable as the average temperature is 19°C–22°C throughout the year, but the daily range of temperature is great. The average annual temperature in the capital Kigali is 20.5°C and the annual precipitation is 1059.5 mm.

Figure 4.1 Location of Rwanda

2. The internal political situation

Before Rwanda became independent in 1962, Hutu (85% of the total population) had been repeatedly fighting Tutsi (14%). After the independence, the majority side Hutu took power and often persecuted the minority side Tutsi. In 1990, the Rwandan Patriotic Front mainly consisting of Tutsi people who had escaped to Uganda during independence invaded Rwanda by arms, which triggered a civil war with the Hutu government. In August 1993, both parties reached the Arusha Peace Accord. After the agreement, the United Nations dispatched United Nations Assistance Mission for Rwanda (UNAMIR) to monitor cease-fire. However, when President Habyarimana was assassinated in April 1994, Hutu extremists started genocide on Tutsi and Hutu moderates, killing 0.8–1 million people in three months, i.e., by July 1994.

In July 1994, the Rwandan Patriotic Front brought down Hutu extremists by arms and a new government with President Bizimungu (Hutu) and Vice President Kagame (Tutsi) was formed. The

[14)] For basic information on Rwanda, see the website of the Ministry of Foreign Affairs of Japan (www.mofa.go.jp/mofaj/area/rwanda/data.html).

government worked to reconcile the people to get over the ravages of the genocide by abolishing identification cards showing a clan (1994), reforming the property inheritance system to allow females to succeed to property (1999), and setting up the National Unity and Reconciliation Commission and National Incident Commission (1999).

In March 1999, a zone-level election (zones are ranked lower than cities, towns, and villages) was held for the first time since the genocide in 1994. In March 2001, a municipality-level election was held. In August 2003, a presidential election was held and Kagame was elected as the president. In all the elections held after that for members of the Senate (2003 and 2011) and Chamber of Deputies (2003, 2008, and 2013), the ruling party Rwandan Patriotic Front (RPF) won.

In 2000, the government announced medium- and long-term national development plan VISION 2020 aiming at turning to a middle-income country by 2020 and realizing knowledge-intensive economy.

President Kagame (re-elected in the presidential election of 2010) has been working to eliminate official corruption. Of special note is that Rwanda has less corruption and is safer than other African countries. In addition, the ratio of female diet members in Rwanda is the greatest in the world at 57.5% (as of October 2014). Female politicians occupy important posts of the vice-chairperson of the Senate and the chairperson of the Chamber of Deputies. The ratio of female cabinet members is approximately 26%. Thus, females have gained a foot in the society.

In 2007, the government released the second Economic Development and Poverty Reduction Strategy (EDPRS II), which was a Rwandan original growth strategy. Recently, the national budget has been allocated to the economic structure reform, farming village development, job creation for the younger generation, public accountability, and other similar sectors predominantly. The government places the greatest importance to the economic structure reform, in particular.

3. Economy

The agricultural, forestry, and fishing industries account for >30% of GDP and approximately 80% of the labor population (2011 by the World Bank). In 1980s, the Rwandan government worked to reconstruct the economy by conducting a structural adjustment plan. However, after the civil war began, Rwanda registered a negative growth and further suffered a devastating blow by the genocide in 1994, in particular. After that, by 1999, GDP recovered to a level similar to that before the civil war, thanks to steady recovery of agricultural production (recovered to the level before the civil war in 1998), aid from donor countries, and sound economic measures.

The Rwandan government formed a public investment plan in 1996; the long-term development plan VISION 2020, which set up the economical goal in 20 years, in 2000; Full Poverty Reduction Strategy Paper (F-PRSP) in 2002; and Economic Development and Poverty Reduction Strategy (EDPRS), which was the second-generation PRSP, in 2007. It has been implementing economic measures with these strategies as the core. Rwanda reached the decision point of the extended Heavily Indebted Poor Countries (HIPC) Initiative in December 2000 and reached its completion point in April 2005.

Rwanda ranked high in Doing Business (2015 by the World Bank), ranking 46th among 189 countries/regions in the world, 3rd in Africa, and 1st in the East African Community (EAC).

The table below lists social and economic indexes of Rwanda.

Table 4.4 Social and economic indexes of Rwanda

Item	Details
1. Main industry	Agriculture (e.g., coffee and tea)
2. GDP	8.27 billion dollars (2015, World Bank)
3. GNI per person	732 USD (2015, IMF)
4. Economic growth rate	6.9% (2015, World Bank)
5. Price rise	4.5% (2015, IMF)
6. Total amounts of trade (2014, EIU)	(1) Export: 0.723 billion dollars (2) Import: 1.99 billion dollars
7. Main trading items (2014, EIU)	(1) Export: Coltan, tin, tea, and coffee (2) Import: Consumer, intermediate, and capital goods, and energy
8. Main trade partners (2014, EIU)	(1) Export: China, the Democratic Republic of the Congo, Malaysia, and Thailand (2) Import: Uganda, Kenya, India, and China

2) Situation of the water supply sector in the target country

The Rwandan government aims at making the water supply rate in the whole country 100% by 2018 as per the long-term development plan VISION 2020 and EDPRS II (it was 50% as of 2000). Therefore, the Rwandan government considers development and repair of basic infrastructure (mainly, water supply sector in urban areas) to be the most important task. EDPRS II plans to repair existing aged water treatment plants, construct new ones, improve the water supply network, and develop water pipes. In addition, the National Water Supply Policy (NWSP) determined in November 2016 lists promoting decentralization of power, PPP, and aid and cooperation as important tasks along with adjustment for securing finances and measures for people who have no access to the source of water supply. The policy also specifies that the Water and Sanitation Corporation (WASAC) should take the lead in determining the master plan, considering necessary activities, calculating necessary budgets, rehabilitating and extending existing facilities, and constructing new ones.

Rwanda has adopted Sector Wide Approaches (SWAp), which the Sub-Saharan African countries adopted as a form of comprehensive aid, and the government has included it in NWSP. A project used to be conducted by discussion between the aid-receiving country's organization that conducted the actual project and each of the donor countries or international agencies. On the contrary, in SWAp, multiple projects are combined to form a program for cooperation, and organizations implementing the projects, government offices in charge, donor countries, international agencies, and NGOs related to the sector cooperate to allow multiple organizations/agencies to provide support to the whole sector. SWAp aims at a more efficient cooperation by reducing the number of overlapping projects and burdens in aid-receiving countries. Its lead donor is JICA. As specific activities, information is shared on the SWAp administration office website, periodic Sector Working Group meetings are held, and joint sector review is performed once a year.

Figures 4.2 and 4.3 show the structure of the water supply sector in Rwanda. As shown in the figures, the Ministry of Infrastructure is responsible for determining development policies in the water supply sector and supervising and monitoring WASAC. The actual agency to implement water service projects for water supply in urban areas is WASAC.

Meanwhile, in the provinces, the districts or private companies under a contract with the districts conduct water service projects (PPP scheme) and the local bureaus under WASAC provide technical support (Figures 4.2 and 4.3). Private companies need to have a license to conduct water service projects under a contract. A license is given to private companies in accordance with standards determined by the Rwanda Utilities Regulation Agency (RURA).

Currently, multiple entities exist in a single district to administer rural water supply. Many of them are small entities with a small number of customers and small income, and hence, private entities with sufficient techniques and private investment cannot be expected. To improve such a situation, a new framework for the licensing system is under development such as improving the levels of details in contracts with private companies, procurement procedures, and contract management.[15)]

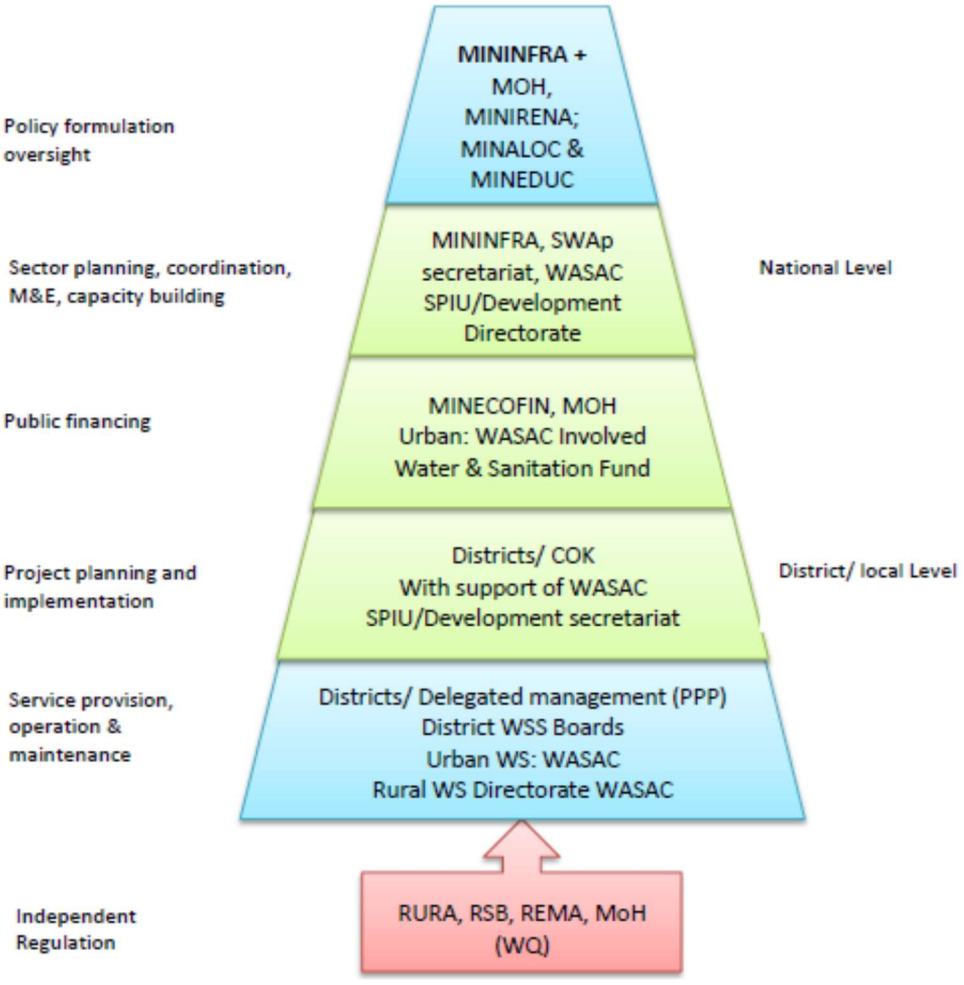


Figure 4.2 Main roles and responsibility of the organizations/agencies in the water supply sector in Rwanda[16)]

[15)] National Water Supply Policy Implementation Strategy, 2016
[16)] National Water Supply Implementation Strategy, 2016

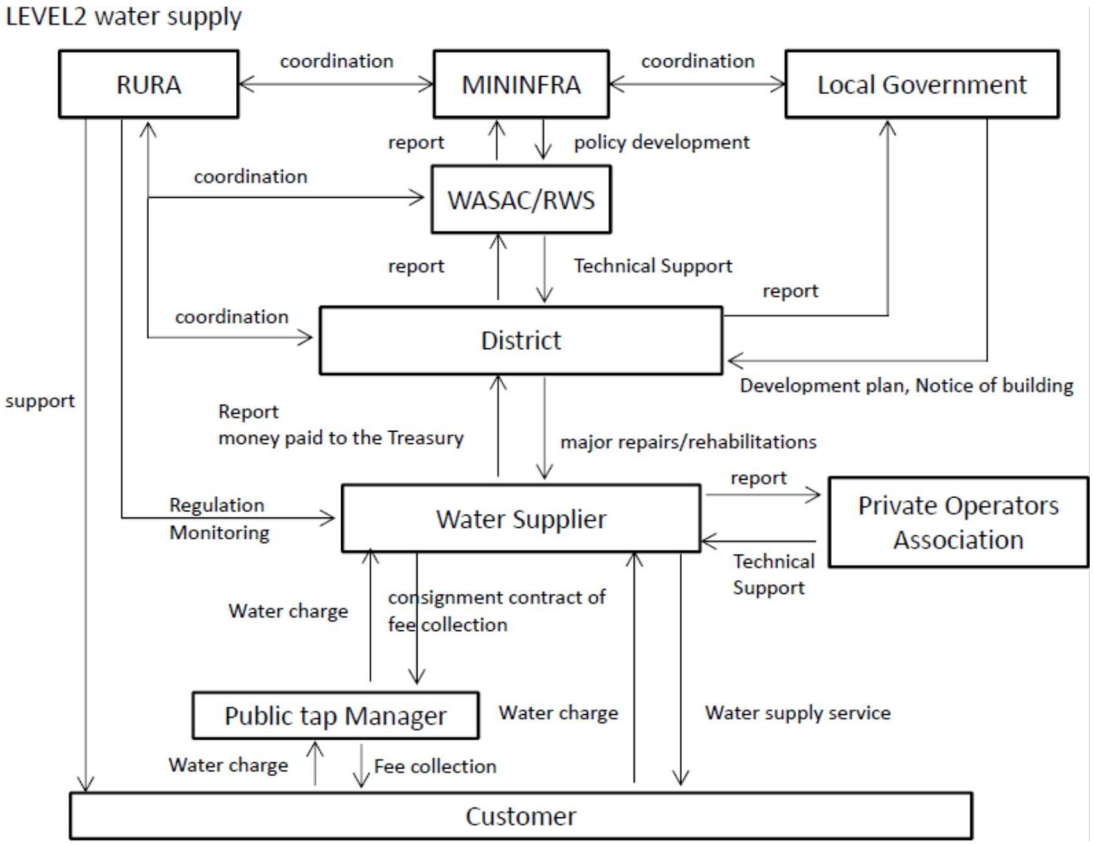


Figure 4.3 Structure of water supply in the provinces (Level 2)[17)]

With respect to the actual state of water supply, the capital Kigali has been seeing a rapid increase in the population and the extension of water supply facilities cannot catch up with it. The average water supply time per day is eight hours, and constant water supply restriction in Kigali is unavoidable because the amount of water to be supplied is not enough and the water supply is suspended. The existing water pipes were constructed in 1970s or before that. Water supply facilities have significantly aged and have not been properly maintained and managed; therefore, the non-revenue water was approximately 40% as of 2015. WASAC, which mainly conducts water supply projects in the urban areas under the supervision of the Ministry of Infrastructure (MININFRA), has been increasing the amount of water to be supplied in Kigali according to a plan for constructing a new water treatment plant and extending the existing plants in public–private partnership. In addition, the length of pipes in Kigali accounts for approximately 40% (2500 km) of the urban water supply network in whole Rwanda. The government is planning to develop and repair the grid to meet the increasing demand for water supply, but the plan for increasing the amount of water to be supplied is delayed.

Regarding water supply in the provinces, many grid water supply systems are for sending water with pressure pumps to houses gathered along ridges approximately 200 m high from water sources on valley floors. Therefore, as its characteristics, the operation costs are high and the capacity required for maintenance and management is at a level same as that of water supply in the urban areas.

[17)] National Water Supply Implementation Strategy, 2016

However, technical levels of many water service providers (WSPs) are low and fees are not properly collected; therefore, when pumps and other parts break, they cannot be repaired because of shortage of budget and are left unhandled in some cases.

Under such a situation, the Rwandan government worked to enhance support to WSPs, which had used to be provided by the districts under decentralization of power, and the Rural Water Services (RWS) of WASAC started controlling water supply in the provinces in 2014. Like this, the structure for improving maintenance and management is under development, but roles that WASAC RWS should fill, organizational structure, and capability of the staff need to be further improved. Specifically, national systems, standards, guidelines, and manuals for operating, maintaining, and managing water supply in the provinces have not been well prepared; therefore, effects of cooperation in a single district cannot be spread to other districts and WSPs well in actual fields.

Table 4.5 Cooperation in the water supply sector of Rwanda

Fiscal year	Name and description	Outline
1983–1986	Study for a plan of daily life water development in the eastern part (development study)	Planning a schedule for rural water supply in the former Kibungo prefecture
1986	Plan of daily life water development in the eastern part (grant aid)	Procuring excavators and constructing wells
1989–1991	Study for a plan of daily life water development in the eastern part (development study, F/S)	Planning a schedule for rural water supply in the former Kibungo prefecture
2005	The Kibungo prefecture local development program (project formation study)	Excavation and formation in the Kibungo prefecture project
2006	The Project for Rural Water Supply (first of the three terms) (grant aid)	
2006	Project for Strengthening Operation and Maintenance of Rural Water Supply Systems (dispatch of experts)	
2007–2010	Improvement of Water Supply and Sanitation in the South Part of Eastern Province (technical cooperation project)	Operating, maintaining, and managing water supply facilities in the eastern prefecture
2008–2009	Development Study for the Improvement of Rural Water Supply (development study)	Formulating water supply M/P for the eastern prefecture
2010	The Project for Rural Water Supply (Phase II) (grant aid)	Constructing facilities scheduled in the second and third terms of the rural water supply plan (three terms in total)
2015–2019	Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda (technical cooperation project)	
2016–2019	Project for Strengthening Non-Revenue Water Control in Kigali City Water Network (technical cooperation project)	Yokohama Water participated in the project

According to data by WHO/UNICEF JMP,[18] the access rate to basic water sources in Rwanda increased from 47.3% in 2000 to 56.7% in 2015 in the entire country, the rate in the urban areas increased from 73.2% in 2000 to 77.0% in 2015, and the rate in the provinces increased from 42.4% in 2000 to 48.5% in 2015. In addition, the access rate to safe water sources in urban areas increased from 26.0% to 36.4%, showing that the access to safe water sources was improved for the entire country. Considering that the population in the urban areas was approximately half of that in the provinces, the access rate to safe water sources was 13.5% in 2015. More input is possibly required to reach SDG6. In addition, some have pointed out that results of JMP are not based on the actual situation; therefore, the actual situation and reliability of data need to be checked in a field survey.

4-3 Outline of the Field Survey

1) Schedule for the field survey

Table 4.6 shows the schedule for the field survey. It was designed to include as many office interviews and observation tours as the time allowed, mainly in the Ministry of Infrastructure (MININFRA), which managed water supply services, and the Water and Sanitation Corporation (WASAC), which managed urban and rural water supplies across the country.

As several Japanese international cooperation projects were being conducted at the same time, we were able to receive kind support from those involved in these projects in many different aspects, including observation tours and survey arrangements.

Table 4.6 Schedule for the field survey

Date and time		Schedule and place	Aim
Saturday, December 9 Sunday, December 10	23:50 15:10	Haneda – Doha (transit) Arrival at Kigali Airport	
Monday, December 11	8:20	Visit to MININFRA	Pay respect and collect information about MININFRA
	10:00	Visit to the Kadobogo district (in Kigali City)	Ascertain the implementation status of measures to reduce non-revenue water
	14:00	Visit to WASAC	Gather information about the general activities and rural water supply services of WASAC
Tuesday, December 12	9:00 10:30 12:00	Visit to WASAC Visit to the Nzove Water Treatment Plant Visit to the Kimisagara Water Treatment Plant	Gather information about the urban water supply services of WASAC and visit water treatment plants, water quality measurement facilities, etc. on observation tours
	15:00	Visit to the Ntora Reservoir	Learn about an urban water supply improvement project through an observation tour

[18] https://washdata.org/data#!/rwa

Date and time		Schedule and place	Aim
Wednesday, December 13	7:30 9:00 11:00	Travel to the Eastern Province Visit to the Rwamagana Branch of WASAC Visit to the Muhazi Water Treatment Plant	Gather information about urban and rural water supply management at a WASAC branch in Rwamagana in the Eastern Province and visit a water treatment plant on an observation tour
	13:45 16:00	Visit to the Ayateke Star Company Visit to the Nyankora Scheme (rural water supply project) sites	Gather information at a village water supply management company and visit water resource wells, etc. on an observation tour
Thursday, December 14	7:00 9:30	Travel to Kigali On-site observation of water line breakage in Kigali City Visit to the Nyamirambo Branch of WASAC (in Kigali City) Visit to the Kadobogo district (in Kigali City)	Gather information about urban water supplies at a WASAC branch in Kigali
	14:00	Tour of WASAC material storage	Learn about challenges facing urban water supplies through an observation tour
Friday, December 15	9:00 10:30	Visit to the Embassy JICA Office reporting etc.	Report survey results and exchange opinions concerning the situation in Rwanda
	16:20	Kigali – Doha (transit)	
Saturday, December 16	19:00	Arrival at Narita Airport	

2) Members of the field survey team

Table 4.7 Members of the Rwanda field survey team

Member	Position	Remarks
Ryota Ushio	Unit Chief, Office of Global Health Cooperation, International Affairs Division, Minister's Secretariat, Ministry of Health, Labour and Welfare	
Daisuke Nakamura	Assistant Manager (in charge of international affairs), International Division, Yokohama Water Works Bureau	Committee member
Tatsuo Morimoto	Senior Advisor, Federation of Japan Water Industries, Inc. (Formerly served as General Manager of Oversea Division, Disaster Reduction and Water Development Department, Pacific Consultants Co., Ltd.)	Committee member
Takeo Yamaguchi	Technical Advisor, Japan International Corporation of Welfare Services	Secretariat

3) Organizations visited

Table 4.8 shows organizations visited for the field survey as well as aims and outline of the visits. Although national policies are under the control of MININFRA, it is WASAC that has central control over the overall implementation of specific operations. Gathering information was relatively easy as the team was able to receive information from key persons from WASAC.

In addition, on-site observation tours provided the team with invaluable opportunities to witness and learn about how local water treatment plants, communal water taps, etc. were operated, how the non-revenue water control project was implemented, and so on.

Table 4.8 List of organizations visited for the field survey

Organization visited	Remarks	Main interviewee
MININFRA	MININFRA manages water supplies for the entire nation under its control. The team visited it to find out about its method of collecting basic information, system, and future orientation of water administration.	Mr. Fidele NTEZIYAREMYE (Secretary Coordinator)
WASAC Headquarters	WASAC is directly engaged in urban water supply services across Rwanda and supervises rural water supplies. The Headquarters is in charge of planning and managing water treatment plants, water quality control, and water conveyance and distribution. The team had observation tours of the Nzove Water Treatment Plant and Kimisagara Water Treatment Plant.	Ms. Gisele UMUHUMUZA (Deputy CEO, WASAC) Mr. Methode RUTAGUNGIRA (Director, Urban Water and Sanitation Service) Mr. Emmanuel NIWENSHUTI (Unit Head of O&M, RWSS) Mr. Mayuzumi (Expert, JICA)
WASAC Rwamagana Branch	The branch is in charge of field management, such as collecting charges and detecting and repairing leaks, and management of private sector companies engaged in rural water supplies. The team visited the Muhazi Water Treatment Plant.	Mr. Sylver Gatera (Rwamagana Branch Manager, CS)
WASAC Nyamirambo Branch	The branch is in charge of field management, such as collecting charges and detecting and repairing leaks.	Ms. Saranda Catherine (Nyamirambo Branch Manager, CS) Mr. KANAMUGIRE Noel (Distribution Service Operator, Urban Water and Sanitation Services)
Ayateke Star Company	The company is a private sector water supply administrator operating in Rwagamana and other places and is a counterpart of the Rural Water Supply Project.	Mr. Cyprien SEBIKWEKWE (Managing Director)
Embassy of Japan in Rwanda	Representing the Japanese government, the embassy has control over grass-root cooperation, etc.	Mr. Takayuki MIYASHITA (Ambassador Extraordinary and Plenipotentiary) Mr. Fujimoto (Economic Cooperation Coordinator)

Organization visited	Remarks	Main interviewee
JICA Office	Japan has been the lead donor in the water and sanitation sector since 2014.	Ms. Kagota (Staff member, JICA Rwanda Office)
Office for the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network	The office has been set up inside WASAC to provide technical cooperation to WASAC for three years, starting in 2016.	Mr. Yoda (Kyowa Engineering Consultants Co., Ltd.) Mr. Takahashi (Tokyo Waterworks International Co., Ltd.) Mr. Momozono (Yokohama Water Co., Ltd.)
Office for the Rural Water Supply Project in Kigali City	The office has been set up inside WASAC to provide technical cooperation in the four model districts in the Eastern Province for four years, starting in 2015.	Mr. Yoshikawa and Mr. Kawamoto (Kokusai Kogyo Co., Ltd.)

4) Survey items and questionnaire

The outline of the questionnaire for the field survey is as shown below (the English version was used). The items in 1) and 2) aim to assess conditions in each country by keeping in mind the indicators for SDGs and to evaluate needs and activities in the water and sanitation sectors, respectively.

Several indicators are adopted for evaluating projects implemented by the Japanese government: population served, water supply coverage, increase in the treatment capacity of water treatment plants, and number of days of interrupted water supply per year, etc. for grant aid and loan aid cooperation programs and improvement in non-revenue water rate, reduction in water treatment cost, and number of human resources developed, etc. for technical cooperation. Relationships between these indicators and SDG indicators are reflected in the creation of items in 1).

Table 4.9 Items surveyed in the field survey

Category	Item	Information required	Question
1) Information collection	1-a) Water coverage ratio in the target area	How populations are calculated How populations served by individual water supply services are calculated	Who collects population data (census), by what method, and at what frequency? Who collects the water coverage population data, by what method, and at what frequency?
	1-b) Number of connections, population served (No. of households)	How is the number of connections for each water supply service calculated	Who calculates the number of connections, by what method, and at what frequency? How is the discrepancy between the number of connections and households identified? How are the numbers of connected households and people calculated?
	1-c) Hour of water supply (hours/day)	How is the duration of water supply for the number of connections of each water supply service calculated	Is the duration of water supply recorded? Is there a program to switching distribution areas, if any?
	1-d) Water tariff, tariff system	How is the water tariff decided for each water supply service	Are there clear grounds for water tariffs and the tariff system?
	1-e) Water quality monitoring	How is the water quality monitored, what management items are adopted, and how often it is monitored	Are there good grounds for items inspected, such as water quality standards, frequency of water quality inspections, and inspection sites?
	1-f) Other	Others (related to monitoring of SDGs)	Are there other organizations involved in SDG monitoring? Are there other items that require attention?
2) Priority issues	2-a) Issues related to water governance and needs for Japan's cooperation	National goals and plans, improvement in the legal framework related to water supplies, and division of urban and rural duties	How are administrative systems and organization structures for water supply improvement and promotion of rural water supply services, and related laws, including Water Supply Act, going? Are there any challenges faced by these administrative systems?
	2-b) Issues related to urban water supply	The urban water supply system and promotion, NRW control measures, and water quality control	What about conditions and challenges concerning "non-revenue water control measures," "water quality control (chlorination)," and other aspects of urban water supply? Are there any challenges, areas, etc. for which cooperation from Japan and JICA is sought after?
	2-c) Issues related to rural water supply	Rural water supply promotion and groundwater contamination control measures	What about conditions and challenges concerning "rural water supply coverage," "groundwater contamination control," and other aspects of rural water supply? Are there any challenges, areas, etc. for which cooperation from Japan and JICA is sought after?

Category	Item	Information required	Question
	2-d) Issues related to organizational management	Maintenance and management improvement and training system	What about the current state and challenges concerning the maintenance and management of facilities in terms of technology and finance, financial conditions and challenges, and current state and challenges concerning technological human resource development?
	2-e) Issues related to public relationship and customer communication	Collection of charges, public relations system, and customer communication	What about means of public relations, customer communication tools, complaint handling and other troubleshooting methods, and recognition levels of the Japanese projects?
	2-f) Priority issues considering current situation	Relationship between SDGs and policy objectives, and priority issues	What issues should be given top priority to achieve SDG6, including all of the above? What kind of cooperation do you seek to receive from development partners to resolve the issues?
	2-g) Securing human resource, its improvement	Development and maintenance of human resources for management and water supply	How are technical human resources developed in the area of water supply technology? What decision-making systems are in place for the employment, promotion, qualification, and compensation, etc. of managerial and technical personnel?
	2-h) Assistance from other countries	Building a relationship with other countries	What relationship exists with countries other than Japan and what support is provided by them at the moment? Is there anything Japan should learn from them in terms of the amount of funds, target areas, method of involvement, speed, etc.?

Questionnaire for "Study of International Cooperation in the Water Supply Sector"

Topic	Question
1) Information collection The objective of this section is to know how the data for Joint Monitoring Program by WHO/UNICEF is collected in Rwanda and to obtain actual data	
1-a) Water coverage ratio in target area	-Population in target area How population data (CENSUS data etc) are collected? Who is responsible of collecting them and how often it is revised? -Population served by water service (In case of rural area, population covered by protected and safe water source) How the population served by water service is counted? Who collects the data in what way? How often the data is revised?
1-b) Number of connection, population served (No. of household)	- Number of connection Who counts number of connection to water service system? How to know the gap between Number of connection and household number obtained by census? How to calculate number of household connected, and population served?
1-c) Hour of water supply (hours/day)	How many hours per day is water supplied? Please provide us the record of supply hours, the scheduled program to switch distribution area and related information if there are any.
1-d) Water tariff, tariff system	What is the formula/method to calculate water tariff? Please provide us the regulation/guideline for fixing tariff if there are any, and explain if the method is clearly written.
1-e) Water quality monitoring	What is the status of water quality standards achievement? Please provide us the monitoring methods such as items for monitoring, frequency, monitoring points etc. Is the monitoring record stored?
1-f) Other	If there are any other organizations/actors, who participate in the process of SDG6 monitoring, please specify the name of actor and their role in the process.
>To be continued to next page	

2) Priority issues The objection of this section is to understand current issues in specific areas, such as urban water supply, rural water supply, organizational management and public relationship, and aim to seek the possibility of further cooperation based on Japan's expertise.	
2-a) Issues related to water governance and needs for Japan's cooperation	How is the progress of expanding water supply network in urban area and rural water supply? What is the policy, governing system, institutional arrangement for implementation? What is the issue related to governing system of water supply?
2-b) Issues related to urban water supply	What is your current situation in terms of "Non Revenue Water reduction" and "water quality management"? Are there any other priority issues to be addressed? What do you expect from Japan's cooperation in tackling with those issues?
2-c) Issues related to rural water supply	What is your current situation in terms of "expanding rural water supply" and "groundwater contamination" in your area? Are there any other priority issues to be addressed? What do you expect from Japan's cooperation in tackling with those issues?
2-d) Issues related to organizational management	What is your current situation in terms of "Management improvement", "Operation and Maintenance of facilities" and "human resource development (especially technical human resource)" ? Are there any other particular issues to be addressed? What do you expect from Japan's cooperation in tackling with those issues?
2-e) Issues related to public relationship and customer communication	- What is the means of communication with your customers? How do you deal with complaints and other trouble with customers? - What is the perception of Japan's cooperation? Is it widely known? In your opinion, does Japan's cooperation have positive/negative impact? If so, what kind of impact does it have?
2-f) Priority issues considering current situation	In your opinion, what is the most important issue in achieving SDG6 in your country? What kind of assistance do you expect from cooperation partners to deal with those issues?
2-g) Securing human resource, its improvement	- How do you recruit the head, management executives and technical experts in water utilities? How do you train and secure them in the organization?
2-h) Assistance from other countries	Are there any bilateral/multilateral cooperation partners other than Japan? If so, what is the characteristic and status of those assistance? Are there significant characteristics of those assistance?

4-4 Results of the Field Survey

The table below summarizes the results of the field survey based on answers from interviewees to the questionnaire in the order in which they were asked. Details of the interview are as described in the attachment.

1) A: Assessment of conditions in each country by keeping in mind the indicators for SDGs

To obtain data to grasp the current conditions in Rwanda, relevant organizations were interviewed with attention given to their collection and analysis systems. It seems that targets set by the national strategies of Rwanda are fairly high with respect to the current situation, but working-level officials are making efforts to achieve them partly because of the leadership of the President. WASAC has control over water supply across the country, which is small in size, and RURA is set as a monitoring organization. Thus, it seems that their data collection system is adequate and information accuracy seems to be adequately reliable.

Topic	Necessary information	Survey results	Summary and remarks
1-a) Water coverage ratio in the target area	How populations are calculated How populations served by individual water supply services are calculated	● [WASAC Headquarters (HQ)] They have the ambitious target of achieving a water coverage ratio of 100% by 2024. They aim to expand the water coverage ratio through a seven-year government plan, antipoverty strategies, national strategies, etc. ● (MININFRA) The Research Institute for National Strategies collects social information by census and other means and compiles reports submitted to JMP. They conduct a household survey once every four years. ● (MININFRA) The up-to-date status of water supply is reported in the joint sector report prepared annually by WASAC. ● (WASAC HQ) Population data were updated in 2016. Next, data will be updated in alignment with Vision 2020. ● (WASAC HQ) Data from a comprehensive household survey conducted in 2014 separate from the census in 2012 also provides basic information. ● (WASAC HQ) The current water coverage ratio is approximately 85%, and the idea of using a new GIS system, which is in the process of being introduced, to grasp the coverage of water supply is under consideration. They want to use this GIS for customer management. They want to manage water meters, numbers, and all other data. ● [WASAC Rwamagana Branch (RW)] The urban population served by water service is calculated by multiplying the number of connections by five people.	● The water coverage ratio target set by the national strategies does not always reflect the reality, but serves as a target for working-level officials partly because of the leadership of the President. ● They collect population information once every four years properly by a census, a household survey, or other means and its reliability is high. ● The population served by water service is calculated by multiplying the number of connections by 5, which is considered as the average number of people per household, and its reliability is somewhat low.

Topic	Necessary information	Survey results	Summary and remarks
1-b) Number of connections, population served (No. of households)	How is the number of connections for each water supply service calculated	● (WASAC HQ) The population served by public taps is an estimate. The populations served by spring water, wells, etc. are also estimates. ● (WASAC RW) As for rural water supply, they make calculations based on the number of residents living in a radius of 500 m. They are working to narrow the range to a radius of 100 m.	● Numbers of connections in individual households are the actual numbers, but numbers of connections for public taps, wells, etc. are estimates.
1-c) Hour of water supply (hours/day)	How is the duration of water supply for the number of connections of each water supply service calculated	● (WASAC HQ) They have a team organized to monitor water supply conditions and water quality, which visits different areas and checks water supply conditions. ● (WASAC HQ) The call center receives complaint calls when water is not supplied. They collect this information and summarize it every morning. Records kept in computers can be analyzed. ● (WASAC HQ) In rural areas, Districts estimate water supply hours based on reports from private operators. ● (WASAC HQ) Many public taps are managed by private operators in communities. In some areas, water supply is limited to 5–8 hours per day. Because operators go home after office hours, water is supplied only at a certain time period in the day, such as between 6 in the morning and 3 in the afternoon. ● (WASAC RW) Basically, water is supplied around the clock, but in high-altitude areas, water is supplied for approximately 16 hours per day. Areas difficult to supply with water can be determined from their topology. ● [WASAC Nyamirambo Branch (NY)] Water supply cannot meet the increasing demand. They expect technical support and investment from Japan. It is difficult to send water to a high-altitude area. ● (WASAC NY) Currently, the limited supply capacity is shared. Based on a share program, water is supplied three days per week. They aim to supply water for at least five days per week by December 2018. ● [AYATEKE (a private operator)] They supply water around the clock as long as there is no problem.	● Approximate water supply hours can be grasped for each water supply area and public tap based on the actual conditions. ● In some areas with insufficient supply of water, water supply is suspended in a planned manner, and local counterparties understand that this is a high-priority issue.

Topic	Necessary information	Survey results	Summary and remarks
1-d) Water tariff, tariff system	How is the water tariff decided for each water supply service	● (MININFRA) Water tariffs are set based on the regulations of Rwanda. ● (WASAC HQ) A cost-based tariff proposal is submitted to MININFRA and approved by RURA after discussion. An operation and maintenance license is also granted by RURA under laws. ● (AYATEKE) They use water tariffs set by RURA but can negotiate with RURA about the tariffs. ● (MININFRA) Water tariffs cover OM costs only. Construction investment comes from public funds. As a criterion for calculating water tariffs, they use a formula of four parameters used by a consultancy. Water tariffs are based on this formula. ● (WASAC HQ) Costs include salaries, chemical costs, OM fees, electricity costs, distribution costs, and other VATs but at present, do not include capital expenditures (CAPEX). ● (WASAC HQ) They try to make proposals and negotiate in consideration of purchasing power, financial conditions, and other factors, but not all proposals are accepted. ● (WASAC HQ) WASAC has only a single country-wide water tariff system, which charges different water tariffs between urban and rural areas. Water tariffs depend on the public tap, household income, topology, water supply system, and other factors. ● (WASAC RW) WASAC uses a single water tariff system, whereas private companies charge different water tariffs depending on the water supply method, which are calculated by a formula. A list of water tariffs is available in the website of RURA. ● (WASAC HQ) To use water efficiently, water tariffs are based on a progressive tariff system (gradual increase system). ● (WASAC HQ) Water is a basic human right, and water tariffs cannot be set freely. ● (WASAC HQ) Water tariffs are kept at levels that everyone can pay. The social tariff ranges between 0 and 5 francs, and water tariffs increase with the increasing amount of water distributed with public taps. This is essentially to support the poor. ● (WASAC HQ) Base prices are set for a 20-L jerrican. Eight francs/jerrican for a gravity flow system, 25 francs/jerrican for a diesel system, etc. ● (AYATEKE) Each customer is charged by the jerrican (20 L). The minimum quantity is 1 jerrican.	● The water tariff system and process of setting and revising water tariffs are clear. ● As an independent regulatory agency, RURA supervises water tariffs and service levels and monitors burdens on citizens. ● In 2013, a law concerning minimum service levels required for water supply operations was enacted.[19] Based on the law, RURA grants private operators and individuals a license to operate and maintain waterwork facilities and works to maintain the service level. ● The progressive system and other measures have been taken. ● Their water tariffs do not fully recover costs, including investment, but they recognize the significance of cost recovery. ● In Rwanda, WASAC has control over water supply across the country and their working-level officials are sufficiently able. It appears certain that they can collect and grasp information properly. ● WASAC uses a single water tariff system, which makes it very easy to know

[19] Website of the RURA (www.rura.rw/index.php?id=74)

Topic	Necessary information	Survey results	Summary and remarks
		● (WASAC NY) Water tariffs are paid online from customers' bank accounts or via their cellular phones (mobile money). ● (WASAC NY) Water meters are installed in individual households. Public taps are also managed by water meters, and this branch alone manages 105 water meters. ● (WASAC NY) Some customers refuse to pay water tariffs, claiming that water is not supplied. In that case, they negotiate with these customers. They may reschedule monthly payments. ● (WASAC NY) If water tariffs are not paid, they remove water pipes. ● (WASAC NY) Public organizations or hospitals do not refuse to pay water tariffs nor ask for rescheduling of payment. ● (WASAC NY) They use a single, gradual increase water tariff system. ● (WASAC NY) Water theft is subject to a penalty of 10,000–30,000 RF, and failure to pay the penalty is subject to imprisonment for six months.	the water tariff levels of the whole country (If different water suppliers charge different water tariffs, statistics processing or other means are required to grasp the burden levels of water tariffs at the national level). ● Water tariffs are calculated by the jerrican.
1-e) Water quality monitoring	How is the water quality monitored, what management items are adopted, and how often it is monitored	● (MININFRA) The water quality is inspected by WASAC and other major water service providers. There is a plan to allow private contractors to monitor water quality in the future. They are now supporting the building of that monitoring system. JICA provides water quality inspection kits and supports implementation of this plan in other ways. ● (WASAC HQ) A laboratory team inspects water quality. Every morning, the laboratory team samples water, checks water quality, and prepares a report about whether it satisfies standards. If a problem is found, they wash the pipe or check the tank for the cause of the problem. ● (WASAC HQ) Individual water treatment plants have a laboratory, where water quality is inspected. ● (WASAC HQ) The quality of water supplied by private operators in rural areas is checked by WASAC. ● (WASAC HQ) Reports are sent to RURA, which serves as a water quality monitoring system. ● (WASAC RW) Water quality is checked every day by sampling and a report is compiled. ● (WASAC RW) The quality of water used by end users is checked twice a week. The turbidity, pH, and residual salt levels are checked. ● (WASAC RW) Water quality is checked in Kigali according to a predetermined schedule. They give instructions to check water quality via Districts. Check if items comply with the guidelines of WHO.	● Water quality is inspected solely by the monitoring team of WASAC in a well-controlled manner. ● Water quality data are sent to an independent organization responsible for monitoring and a third-party check functions well. The results of monitoring are reflected in investment decisions.

Topic	Necessary information	Survey results	Summary and remarks
		● (AYATEKE) They check water quality on their own, but WASAC checks whether it satisfies standards. ● (Reference) As source data of JMP, water quality data from WASAC is used. Benchmarking of utilities (ESAWAS, 2013–2014).	
1-f) Other	Others (related to monitoring of SDGs)	● (MININFRA) A JMP report created in collaboration with UNICEF and WHO was submitted last year. In response to a request by an official letter, a response is delivered to the reporting system. After collecting information, results are analyzed and discussed. JICA, UNICEF, WHO, AFDB, WATERAID, WASAC, and all those concerned are invited there. ● (MININFRA) Targets for 2050, the successor to Vision 2020, are under development. National strategies are integrated into SDGs here. ● (WASAC HQ) SDGs are very systematic and simple, but are difficult to achieve. It is very challenging to supply water with improved quality every day. ● (WASAC HQ) They have set an ambitious and challenging goal regarding sanitation for the current toilet installation rate of 22% in households. ● To achieve this goal, investment is essential. ● (WASAC HQ) They need to promote measures in different sectors, including agriculture and public sanitation in an integrated manner and make numerous improvements based on improvement strategies. ● (JICA) If importance is placed on quality, there may be support that only Japan can provide.	● JMP reports are created in collaboration with special organizations from different countries. Ministries and agencies are also involved in the creation of these reports. ● When developing national strategies as successors to the current strategies, strategies aligned with SDGs will be clearly incorporated. ● They consider coordinating water supply with measures in agriculture and other sectors rather than promoting water supply projects alone.

2) B: Evaluation of needs and activities in the water and sanitation sectors

Actual conditions of international cooperation in the water supply sector were grasped by interviewing water supply state enterprises, visiting their facilities, and conducting other wide-ranging surveys. Results of the survey in Rwanda are outlined below.

We understand that issues in the water supply sector of Rwanda are renewal of water supply infrastructures developed on an as-needed basis and that have deteriorated over time and building a base of human resources who take on this issue. As shown in a national master plan development and independent accounting of WASAC, they have made steady improvements in policy aspects. However, water rates are not high enough to recover equipment investment, and they rely on aid for fund raising. This is considered a fundamental limitation.

On the contrary, looking at survey results from a higher perspective of participation in international cooperation in Africa, we can see that Rwanda, among other countries in Africa, has a fairly excellent business environment. In addition, a base of Africa Continent-wide activities is located in this country and coordination with sectors other than water supply is considered. Thus, for acquiring knowhow on

international cooperation in the future, Rwanda is a very effective and extremely attractive aid-receiving country.

Topic	Necessary information	Survey results	Summary and remarks
2-a) Issues related to water governance and needs for Japan's cooperation	National goals and plans, improvement in the legal framework related to water supplies, and division of urban and rural duties	● (MININFRA) MININFRA is responsible for overall development in all sectors, including the water sector. Targets in the water sector are given in Vision 2020, under which action plans have been developed. National targets are revised based on the actual progress. ● (JICA's experts) Under the strong leadership of President Kagame, they are making efforts to achieve the targets for 2020. ● (Consultant) National strategies for growth were established in 2013 with help from Singapore. They aim to become "Singapore in Africa." This is why it is easy to start a business in this country. ● (WASAC HQ) WASAC has two roles. One is to get involved in the government's policymaking for enhancing the whole water system as an entity that runs water supply operations. Another is to actually work based on the policies. ● (MININFRA) Decision-making for increasing the coverage of water supply is led by MININFRA. They make selections concerning the expansion of the coverage of water supply based on the balance between the amount of purified water and demand in annual reports. The current water coverage ratio is 83%. ● (WASAC HQ) WASAC applies for construction funds and undertakes construction. Rural water supply facilities are transferred to local governments after construction. Private companies operate and maintain these facilities under a commission from local governments. ● (WASAC HQ) Independence of budget accounting is established. ● (JICA) A special account for water rates has just been opened. This is not enough for JICA to decide to fund large-scale renovation, but is a step forward. ● (Consultant) Rural water supply is under the control of Districts, which are not under the direct control of MININFRA, but are under the control of local ministries. This makes the situation awkward, but they maintain reasonable collaboration. ● Water rates are reviewed annually. As of December 2016, households using water from public taps are charged 323 Rwf/m^3 (approximately 0.39 USD/m^3) and those using water supplied to individual households are charged more with increasing water consumption. For example, they are charged 323 Rwf/m^3 (approximately 0.39 USD/m^3), which is the same rate as public taps, if the monthly water	● The water coverage ratio target set by national strategies does not always reflect the reality, but serves as a target for working-level officials partly because of the leadership of the President. ● Independence of water supply accounting has just been established. ● In Kigali, WASAC owns the waterworks facilities and has the license to run water supply operations. Thus, the city is not directly involved in water supply operations. ● There is a system under which WASAC manages all practical operations for urban water supply across the country, and generally, the division of duties is clear. Rural water supply is managed by local governments. This may conflict with overall management by WASAC, but such conflict is not significant enough to pose a problem.

Topic	Necessary information	Survey results	Summary and remarks
		consumption is between 0 and 5 m^3, and 331 Rwf/m^3 (approximately 0.40 USD/m^3), if it is between 6 and 20 m^3.	
2-b) Issues related to urban water supply	The urban water supply system and promotion, NRW control measures, and water quality control	● (WASAC HQ) In urban areas, WASAC has the license to run water supply operations or operates and maintains facilities and pipeline networks. ● (MININFRA) WASAC reports the current status of water supply through annual reports and RURA monitors service quality. ● (MININFRA) Based on these reports and the results of monitoring, MININFRA develops waterwork facility development plans and other plans in light of the balance between demand and supply and submits them to the Ministry of Finance and Economic Planning (MINECOFIN). Then, these plans are reflected in investment. ● (WASAC HQ) WASAC is responsible for increasing the coverage of water supply. They decide where to update in light of public opinions and the national strategies. To meet growing demand, they are working to increase the coverage of water supply based on strategies. They also pay attention to the occurrence of waterborne diseases, etc. ● (WASAC HQ) Equipment investment comes from the government. They need to recover OM costs on their own from revenue from water supply. ● (WASAC HQ) In rural areas, water supply through pipes is directly managed by WASAC. ● (WASAC RW) Decisions to install or renew facilities are made by the WASAC HQ. ● (WASAC HQ) The highest NRW rate is approximately 35%, and they want to lower it to 25%. They developed a five-year action plan and organized a joint team with JICA to address this issue. ● (WASAC HQ) As countermeasures against NRW, they want to introduce technologies and equipment for monitoring with support from JICA, Japanese government, ADB, etc. They want to request support to complete continuous improvements by 2032. ● (WASAC HQ) To improve pipeline management, they are working to introduce a mapping system in collaboration with a GIS company. They want to manage customers by managing all data, including water meters and numbers. After that, they want to introduce a SCADA system (water distribution management system) and use it on a daily basis in combination with discovery of water leakage and other applications. ● (WASAC NY) To control water leakage, they want to renew old pipelines. They have a policy of renewing them over 40 years.	● It seems that they are working to strategically increase the coverage of water supply in order of priority in light of various factors. ● On the other hand, existing facilities are in a bad condition, and in particular, they recognize that taking countermeasures against NRW because of poor management of the pipelines is an important issue. ● On the other hand, they rely on financial aid-based government spending for investment and cannot inject water rates into this investment. This is considered as an important reason why the pipelines cannot be renewed or their functions cannot be maintained. ● Since they rely on donors for funds, how water treatment plants are developed and the quality or standard of pipeline materials vary from project to project, and unused, decayed materials have piled up in warehouses. Efforts must be made toward standardization.

Topic	Necessary information	Survey results	Summary and remarks
		● (WASAC NY) They find water leakage in two ways. (1) When a customer finds water leakage, he/she reports it to the call center. (2) Commercial field officers or water meter readers determine water leakage from meter readings. ● (WASAC NY) This branch manages water distribution pipes with a diameter of up to 300 mm, and those with a larger diameter are managed by HQ. PVC pipes are mainly used, and steel pipes and DCIPs are also used. When water leakage is found, they stop water supply and repair the leaking part. Basically, they complete this repair in two days. ● (WASAC RW) The most significant issue is that the NRW rate is as high as 52% (in this area, water leakage is found most frequently in Rwanda). Low quality of the materials used is a major cause. AG (threaded steel pipes) was previously used as a pipe material, and PVC is used currently. ● (WASAC NY) Materials are stored in warehouses. Only small ones are stored in this branch. Only materials to be used for three months or so are stored. HQ has a central warehouse.	
2-c) Issues related to rural water supply	Rural water supply promotion and groundwater contamination control measures	● (MININFRA) The private sector is managed by Districts, which have a management department, through which WASAC receives reports. ● (WASAC HQ) Local governments are responsible for rural water supply, and private companies undertake operation and maintenance. ● (MININFRA) RURA monitors service quality as a regulatory organization. ● (MININFRA) To address poor management of water supply infrastructures, management of private operators must be improved. ● (WASAC HQ) In rural areas, 40% of water supply facilities are not functioning. To ensure continuous maintenance and operation of these facilities, management and monitoring of private operators are very important. ● (WASAC HQ) WASAC governs and provides technical support to local governments. WASAC provides various kinds of support. For example, they support local governments in operating budgets for construction projects, developing water sources, digging wells, purifying water, and using rainwater. ● (WASAC BR) They cannot directly give instructions to private companies, which are under the control of Districts. Basically, they cannot give instructions about investment. No agreement has been achieved on this matter among organizations.	● Maintenance and operation for rural water supply are outsourced to private companies, and improving their capabilities is recognized as an issue. ● On the other hand, activities to improve rural water supply are continuously conducted in many ways.

Topic	Necessary information	Survey results	Summary and remarks
		● (AYATEKE) Their operations range from OM to collection of water rates. They do not make investment in equipment but may make minor repairs or expansions. ● (MININFRA) WASAC integrates this information into a joint sector review. This is submitted to MINECOFIN via MININFRA. ● (Embassy) They carry out grass-root grant aid water supply projects across the country. They installed rainwater tanks in the southern part of the country. ● (JICA) The Water Security Action Team is working for rural water supply, starting in eastern districts. In rural areas, water supply systems are not yet maintained on their own. AYATEKE can make minor repairs with their own money, but they actually make repairs only to the extent they can since such repair work is not included in contracts. ● (WASAC HQ) Possible contaminants of water sources include arsenic and mercury in mining areas. The Ministry of Environment, which is responsible for control of water source contamination, monitors groundwater. In areas where water salination is seen, RO may be used. ● (WASAC HQ) To manage the quality of groundwater, they analyze water quality when a well is dug. If the water quality does not satisfy given standards, a well is dug in another place. If contamination is found after a well is dug, it is protected to prevent contamination from spreading. If a problem is found with a local government in a laboratory test, it is reported. ● (AYATEKE) Problems found in water sources include clogging of a well. In a rural water supply project (Nyankora Scheme), they actually visited the village and dug new wells. Pumps are below the ground and their maintenance is difficult and costs money. If these pumps require repairing, they ask WASAC for help. ● (WASAC HQ) They do not have sufficient knowledge about the amount and quality of groundwater, and they would greatly appreciate if surveys could be conducted on how to manage rural water supply, how to develop facilities, and what water quality is like. They expect technical support from Japan.	

Topic	Necessary information	Survey results	Summary and remarks
2-d) Issues related to organizational management	Maintenance and management improvement	● (WASAC HQ) Facilities constructed under the responsibility of WASAC are maintained and repaired under their responsibility. At present, 4 engineers are in charge of these operations, and they have a project to assign 27 engineers to 27 districts in the future. Started in last September, this project will get into full swing in January. ● (WASAC HQ) However, they do not want to undermine the local governments' ownership (autonomy). They make various assessments for technical improvements, but have a policy of respecting the local governments' autonomy. ● (AYATEKE) Private companies conclude contracts with individual Districts. These contracts are three-party contracts including WASAC. ● (AYATEKE) They have meetings with WASAC when needed. ● (AYATEKE) Water rates are put on the account for water supply managed by the company. A merger and other types of consolidation between private companies are permitted. Contracts are re-signed every five years, and competitions take place. ● (AYATEKE) The number of staff members assigned depends on the facility or the construction of the facility. For example, many operators are assigned to a facility with many pumps. How many staff members are assigned is determined by a department director of the company. ● (AYATEKE) Basically, only repair hours are managed by PIs. ● (JICA's experts) Previously, many executive officers suspected of corruption retired from WASAC. However, on what basis were they suspected is not quite clear (it did not seem that they pocketed money). Fair trials take place. Many executive officers were forced out of office all at once, and a major burden was placed on the remaining executive officers.	● WASAC's system is being continuously improved. ● The procedure for selecting private companies maintains a certain level of transparency.
2-e) Issues related to public relationship and customer communication	Collection of charges, public relations system, and customer communication	● (WASAC NY) WASAC has 20 branches, six of which are in Kigali. ● This branch has four departments or departments in charge of pipeline maintenance, accounting, meter reading and connection management, and bill collection. ● (AYATEKE) Public taps are managed by supervisors. In many cases, residents rather than the company's staff members serve as supervisors. ● (WASAC HQ) The call center receives calls complaining that water is not supplied. They collect this information and summarize it every	● There is a mechanism in place that collects complaints from customers. ● Various activities to transmit information are conducted. Characteristic activities to collect the voice of customers are also conducted.

Topic	Necessary information	Survey results	Summary and remarks
		morning. Records kept in computers can be analyzed. ● (WASAC NY) They collect details of communication with customers via the call center. ● (AYATEKE) The call center of WASAC receives all complaints. ● (WASAC HQ) The call center receives approximately 200 calls per day. However, these calls include not only complaints about no water supply but also many other complaints. Protests against projects may be included. ● (WASAC HQ) They engage in publicity through the call center as well as by TV, radio, SNS, and other media. Communication with communities of tap water users may be a good system, but putting it into operation is challenging. ● (WASAC HQ) They communicate with all communities in their home ground through community work. In rural areas in particular, local wash boards cover water- or sanitation-related issues at the local level. Local governments (Districts) raise issues. Issues are also raised by lower levels such as towns, but this is challenging.	
2-f) Priority issues considering current situation	Relationship between SDGs and policy objectives, and priority issues	● (MININFRA) There are problems with the maintenance of infrastructures and quality management. They are making efforts to encourage private operators to improve management. The problem is that private operators lack the capacity to manage water amounts or the existing facilities. ● (MININFRA) Another problem is that they lack financial resources. They lack money to achieve MDGs. It is estimated that in the water and sanitation sector of Rwanda, 100 million USD is required to achieve MDGs and another 289 million USD is required to achieve SDGs. ● (WASAC HQ) Investment is necessary. They need to promote measures in different sectors, including agriculture and public sanitation, in an integrated manner. ● (WASAC HQ) To attract investors' interest, large-scale projects are preferred. They attract various investors by blended finance (* blending different funds of different interests) and promote construction and improvement of infrastructures as well as intangible measures. ● (MININFRA) To resolve revenue shortages, they have expectations for innovative financial approaches. Private funds are one of these approaches. In particular, by an approach called home ground solution community, they request the private sector, investors, development banks or the like, commercial banks, and other parties	● It is understood that acquisition of investment and quality management of existing infrastructures are issues to be addressed. ● To attract investment, measures to attract private funds, such as the launch of large-scale projects, are being considered. ● On the other hand, they financially support households by a microfinance approach. ● In essence, it may be improvisational investment that lies at the root of the issue of the quality management of infrastructures. ● Thus, they try various measures under constraints

Topic	Necessary information	Survey results	Summary and remarks
		for aid. By this approach, they built a system under which households can borrow an amount of money to be borne by them when piping water into their houses. ● (JICA) RDB serves as a gateway to investment in this country, but it was pointed out in a national audit that RDB attracts investment but does not follow up with it. They have a problem with follow-up support. ● (WASAC HQ) As for support from Japan, they expressed two desires. Firstly, they want to gain knowledge from the Ministry of Health, Labour and Welfare and receive technical support and investment expeditiously. Secondly, they need support with respect to management aspects. Specifically, they want Japan to support negotiations to gain an investment package for the critically important master plan in Kigali. ● (WASAC RW) Their requests are as follows: they want to replace the pipe network with new material pipes, expand the coverage of water supply, and take countermeasures against NRW. In particular, they have expectations for training for human resource development. In this sense, they have expectations for the results of pilot projects in Kigali.	placed by the water rate system. They cannot recover equipment investment from water rates and basically rely on aid for the increase of the coverage of water supply. They are facing difficulty investing in maintenance because of lack of funds.
2-g) Securing human resource, its improvement	Development and maintenance of human resources for management and water supply, and training system	● (WASAC HQ) They have an open recruitment system and conduct skill tests for applicants. They recruit new staff through news or their website. They set an announcement period of ≥2 weeks. They check whether applicants satisfy given standards based on TOR and select new staff members after testing and interviews. ● (WASAC HQ) As for whether they have secured adequate human resources, they have secured minimum required human resources as a whole. They have set a minimum required number of staff members and standards. ● (WASAC HQ) Their human resource development training is based on a skill improvement program, which was developed with cooperation from JICA and other parties. ● (WASAC HQ) In rural areas, how many staff members can be employed is limited by local autonomy. The quota is specified by law and monitored. This is based on the African Development Program. ● (WASAC HQ) Not only WASAC but also all other stakeholders secure human resources based on this management system. ● (WASAC HQ) They are providing education and training, including overseas training, on operation of rural water supply for private operators.	● Looking at the ability of staff members who served us and comments of those involved in JICA's projects, it seems that their recruitment and selection systems function properly. ● In some cases, a tendency to control the payroll may hinder the progress of a project. On the other hand, this indicates that they properly manage the staff quota and can be evaluated positively. ● Their human resource development is still in the formative stage, but they have a relatively solid base of human resources. Thus,

Topic	Necessary information	Survey results	Summary and remarks
		● (WASAC HQ) They are in the process of developing new guidelines for human resource development. ● (WASAC HQ) Achievement of targets and salaries are important factors in motivating people. They are also working to keep staff members motivated. ● (Consultant) The executives being too busy may hinder the progress of a project. ● (Consultant) They are working to switch to decentralization from the previous top-down system, but have made little progress. They have not secured adequate number of specialists. This is why technical cooperation projects are now being promoted. ● (AYATEKE) They do not have training systems other than OJT. ● (AYATEKE) When employees leave the company, they place recruitment ads in universities or other institutions.	technical cooperation in the future is expected to pay off.
2-h) Assistance from other countries	Building a relationship with other countries	● (JICA) It is important to build regional and global cooperative relationships. Cooperation within Africa must be promoted, but it seems that JICA's involvement in this area is far from enough. They must still make further efforts. ● (JICA) Established in September 2016, the SDG Center started activities concerning higher education this year. They have jurisdiction over the entire African Continent. JICA also supports their activities, and we may be able to get involved. This opportunity should be used if developing activities in Africa is considered. ● (Embassy) It is easy for Japan, which has no responsibility for the history of the country, to build a relationship there. The national characteristics of the country are similar to those of Japan in that people are honest and shy. They have achieved outstanding economic growth and labor costs are low. ● (JICA) Because Rwanda is a promising aid-receiving country, there is competition between aid agencies. A sense of speed is particularly important in Rwanda. This is partly because the country is impetuous. Japan is slower in action than Turkish companies, etc. The attitude "Japan examines carefully" does not work. Speed must be increased in alignment with other donors. Speed is important in business. ● (JICA) Although changes such as extension of Vision 2020 to 2022 have been made, coordination of and collaboration between donors have been managed properly in Rwanda and meetings have been held on a sector-by-sector basis. Individual donors are aware of their positions, which make it easy to work there.	● The SDG Center, which has jurisdiction over the entire African Continent rather than only Rwanda, is located in this country. This proves that the business ability of the Rwandan government is highly evaluated. ● There is a mechanism by which coordination between aid agencies works. This will work favorably for smooth progress of a project.

Topic	Necessary information	Survey results	Summary and remarks
		● (JICA's experts) JICA recognizes Rwanda as an important country and has established sector working groups. ● (Embassy) It is important to show success stories in TICAD. Since not all case examples in Africa can be introduced, success stories should be presented. In this sense, Rwanda is a good place to introduce. ● (JICA) Currently, they are bringing ideas to the table or preparing case examples of Japan's cooperation for TICAD7 in 2019. Collaboration with TICAD is of great importance. Apart from to what extent such collaboration matters, that should be kept in mind. ● (JICA) Rwanda is densely populated and is easier to work with than other countries in Africa. Its population is as large as that of Cambodia. It has a relatively large amount of water. It is easier to conduct water supply projects in this country than in other countries with a low population density. Rwanda is a good place to let people know Africa. ● (Embassy) On the other hand, Rwandan people share senses characteristic of Africa. In particular, they are careless about time. However, they always keep their promise. They are fond of things that are new (eager to introduce new products or technologies). ● (JICA's experts) Rwandan people are frank, as is typical with African people and do not have a sense of belonging as Asian people have. Tanzanian people are more cheerful, but are, in a way, more brazen. These may be differences depending on whether the country is landlocked.	

Chapter 5 Outcomes of the Study

5-1 Examination of Priority Measures

This chapter discusses the outcomes of the overseas study in the viewpoint of items A, B and C mentioned in Chapter 3.

In particular, on the basis of the findings of the field study in Rwanda, the outcomes are discussed in the following viewpoints: (A) assessment of conditions in each country by keeping in mind the indicators for SDGs; (B) evaluation of needs and activities in the water and sanitation sectors. Thereafter, the viewpoint of (C) expansion to regions with weak ties is discussed in a manner that compares the results of the above discussions on A and B with the situations in Laos and Cambodia studied last year.

In this chapter, the current situations of each country and region from the viewpoint of priority measures are summarized in Table 5.2 and the contents of "Situations in Africa" in the table are the description of the situations from the viewpoint of the activities of JICA in Africa. There has been a shortage in the sources of information that allow the overall situations in Africa to be objectively evaluated on the basis of the activities of other development partners. It is expected that such information sources will become available in the future.

1) A: Assessment of conditions in each country by keeping in mind the indicators for SDGs

This section discuss one of the SDG indicators, namely, Target 6.1 "by 2030, achieve universal and equitable access to safe and affordable drinking water for all."

The calculation of the SDG indicators by WHO/UNICEF is expected to be practically executed by the JMP as a task force in a manner that elaborates the monitoring that has been implemented while achieving the MDGs.

The calculation bases of respective reports by the JMP are basically the hearing results with the ministries and agencies in respective countries in charge of information collection with the support of experts dispatched to these countries if the hearing results are verified to be true after being compared with the results of house-to-house studies obtained by independent implementation in object countries or by the implementation of local consulting firms or research agencies such as NGOs and research institutes commissioned by the WHO/UNICEF office.

However, it has been indicated that ministries and agencies of many of the object countries do not have enough capability to collect information; particularly, data on a local level has not been updated for a long time or on the basis of intuitive estimation.

With this awareness in mind, the results of the respective field study items in Rwanda are compared with those of Laos and Cambodia, as shown in Table 5.1.

Generally, the information collection system in Rwanda is sufficiently advanced and reliable in terms of accuracy and calculation bases. Given the relatively small geographical size and large effect of the nationwide control of the WASAC over the decentralized water supply, Rwanda is determined to have a high possibility to have produced more reliable data than Laos and Cambodia.

By contrast, because information management in other African countries than Rwanda is considered insufficient, it requires reinforcement in assistance activities in the future.

Table 5.1 Comparison of current situations of Rwanda with two Asian countries (Laos and Cambodia) from the viewpoint of priority measures

Priority measure	Rwanda	Laos	Cambodia	Discussion
System to control monitoring	Total population: the National Institute of Statistics of Rwanda Population supplied with water: Ministries and agencies related to social studies including the National Institute of Statistics of Rwanda, the Ministry of Finance and Economic Planning, and the Ministry of Health Although the ministries and agencies have not established a nationwide framework for monitoring population supplied with water, the situations in Rwanda allow information collection to be made easily because the WASAC and RURA have been integrally controlling the supply of water and the monitoring operations, respectively. The information related to the population supplied with water has been compiled not only in the national censuses but also in several other social studies including family budget inquires. The national policies of Rwanda have referred to the water supply rates compiled in the integrated household living condition survey (EICV). The JMP has also used the water supply rates in the EICV. The dissemination target set forth in the national strategies was not necessarily determined on the basis of actual situations but has been functioning as a target for workers partially because of the leadership of the president. Furthermore, the MININFRA intends to introduce the viewpoints of SDGs in the targets of the next national strategies and has worked on the establishment of a management information system (WASH MIS) related to water supply and sanitary in consideration of SDGs in collaboration with development partners.[20)]	Total population: Statistics Bureau, the Ministry of Planning and Investment Population supplied with water: Statistics Bureau, the Ministry of Planning and Investment Laos, as a nation, has not yet established a monitoring framework specializing in water supply rates.[21)] The JMP has used the data obtained on the basis of censuses and other social research results but the frequency of social researches in Laos is low compared to Rwanda and Cambodia. Regarding urban water supply, each prefecture prepares an annual report and submits it to the Ministry of Public Works and Transport (MPWT) in charge of water and sewerage projects, and the ministry compiles the reports. However, the reliability of the data in the report of each prefecture is low.[22)] To improve the situation, JICA's technical cooperation project was implemented to investigate the actual situations of the prefectures and to take measures to improve the reliability. For the years with no social researches conducted, the JMP has calculated estimated water supply rates via a regression analysis on the basis of the trend of water supply rates up to the previous years. Given the low frequency of social studies, the estimated values have been used in many years. Therefore, the monitoring framework in the water supply sector is incomplete, and the reliability of available data for monitoring is considered low.	Total population: the National Institute of Statistics, the Ministry of Planning Population supplied with water: the Ministry of Industry and Handicraft (rural water supply) In Cambodia, the urban and rural water supply has been controlled by the Ministry of Industry and Handicraft (MIH) and the Ministry of Rural Development, respectively. The following shows information on the urban water supply. In its order, the MIH imposes on water utilities the obligation to report some major indexes, including water supply rates. The reports from 13 water utilities are reportedly reliable to a certain extent. By contrast, although the total number is not correctly recorded, there are approximately 200 licensed private water utilities and more than 250 unlicensed ones, and the reliability of their reports is considered to vary widely. The JMP has referred to the results of censuses and social studies. It has been indicated that these results cannot be considered in annual reviews and plans because the JMP uses the results of monitoring censuses and social studies that are conducted on a nationwide scale and require long-term operations until all of the results are tallied.[23)] The JMP seems to have used the information of social studies to modify the water supply rates to suit the definitions of the MDG and the SDG.	Compared with two Asian countries, the monitoring system in Rwanda is sufficiently systematic with adequate frequency of update. Considering Rwanda's effort to make the system consistent with the SDGs, the system has already reached a substantially advanced level. Furthermore, Rwanda is one of the few African countries with advanced IT technologies and aims to proactively use of IT technologies in the monitoring system. By contrast, Laos and Cambodia still have problems with the reliability of data collected in rural areas. Furthermore, because of the low frequency of social studies in Laos (no research results are available for monitoring the degree of attainment of MDGs by 2015), the information collection system in Laos has not been established as a whole.
Water supply rate[24)]*	<Results of the JMP (2015)> 6,584 thousand (urban area: 2,574 thousand, rural area: 4,010 thousand)/11,610 thousand (urban area: 3,345 thousand, rural area: 8,265 thousand)	<Results of the JMP (2015)> 5,472 thousand (urban area: 2,409 thousand, rural area: 3,063 thousand)/6,802 thousand (urban area: 2,627 thousand, rural area: 4,175 thousand)	<Results of the JMP (2015)> 11,679 thousand (urban area: 3,090 thousand, rural area: 8,589 thousand)/15,578 thousand (urban area: 3,228 thousand, rural area: 12,350 thousand)	Considering that the economic situation in Rwanda is in the same level in Laos and that the population of Rwanda ranks between Laos and Cambodia, these countries can be appropriate subjects for comparison.

20) Water and Sanitation 2017/2018 Forward Looking Joint Sector Review Report, www.mininfra.gov.rw/index.php?id=233
21) Water Supply and Sanitation in Lao PDR, https://www.wsp.org/sites/wsp.org/files/publications/WSP-LaoPDR-WSS-Turning-Finance-into-Service-for-the-Future.pdf
22) Water Supply and Sanitation in Lao PDR, https://www.wsp.org/sites/wsp.org/files/publications/WSP-LaoPDR-WSS-Turning-Finance-into-Service-for-the-Future.pdf
23) Water Supply and Sanitation in Cambodia (2015)
24) Water supply rate is defined as "(the population accessible to basic water resources)/(total population)" and each population is expressed by total with its breakdown in terms of urban and rural areas in parentheses.

Priority measure	Rwanda	Laos	Cambodia	Discussion
Total population Population supplied with water Number of water supply connections	The information on population has been appropriately collected by quadrennial censuses and house-to-house studies, and the reliability of the information is high. By contrast, the reliability of the data on the population supplied with water is slightly low because it has been calculated in a manner that multiplies the number of water supply connections by an average household size of five. The number of houses with water supply connections is the actual value, but the number of connections with common faucets and wells is the estimated value.	In the population census conducted in 2015, populations by village were counted by interviewing village heads. The populations after the census have been estimated on the basis of increase rates. The population supplied with water has been calculated in a manner that multiplies the number of water supply connections by the average number of people per general household by the type of use district. The number of water supply connections has been properly counted.	A population census was conducted in 1998 for the first time in 36 years. The second population census was conducted in 2008 with the support of Japan. The third one is planned to be conducted in 2018. http://www.stat.go.jp/info/meetings/cambodia/cambo3.htm http://www.stat.go.jp/info/meetings/cambodia/census08.htm The number of houses connected to public water utilities can be known from customer lists. The population supplied with water has been calculated in a manner that multiplies the number of water supply connections by an average number of users per connection. The MIH has instructed private water utilities to input data into a database system called WSMS, which was introduced with the support of the WB. Although not covering all the private water utilities, the information on the number of water supply connections can be confirmed via WSMS.	The quadrennial population censuses in Rwanda are more frequent than the quinquennial censuses in Japan. In Laos, the frequency of population censuses is once in a decade, and the frequency of other social studies is also lower than that of Rwanda. In Cambodia, the frequency of population censuses is also once in a decade similar to that in Laos, but supplemental studies have been conducted between censuses. Together with other types of annual researches conducted by the government, the social studies in Cambodia have been sufficiently conducted.
Water supply time	The water supply duration by water supply area or common faucet is close to the actual condition. In some areas with insufficient water supply, planned water stoppage has been practiced.	Although the coverage of urban water supply is approximately 20% across the country, 24-hour water supply has been achieved in the coverage areas.	The public water utilities have provided 24-hour water supply in principle but there are some areas with temporary water stoppage during peak times (as of 2017).	Japan has little accumulation of know-how to acquire data on water supply time. However, relatively accurate data can be available because areas prone to water stoppage can be easily identified.
Water rate	The processes to decide and revise water rates and their structures are transparent. Given that WASAC has only one water rate structure, it is easy to understand the level of water rates in the country as a whole. The water rates of private companies vary depending on water supply methods and are calculated according to calculation formulas. A rate table is available in the website of RURA. Although the water rates have not been decided on the basis of full recovery costs, including capital investments, the significance of paying for water rates has been understood by the people.	Each prefecture has its own tariff policy. The people in Laos are relatively serious about paying for water rates.	The structures of water rates vary depending on water utilities. The ministerial order stipulates the processes to decide and revise water rates, and the water rates are subjected to final approval of the MIH. According to the notification of the MIH, all water utilities are requested to supply water up to 3 m^3 at the cost price for purifying it as a bail-out measure for a poverty group (effective since May 2017).	In Rwanda, it is easy to grasp the burden levels of water rates because the structure of water rates is uniform nationwide and because RURA has overall control of the water rates.
Water quality control	The monitoring team of the WASAC has conducted water quality inspections in an integrated manner, and the monitoring has been subjected to a third party verification by the independent organizations in charge of monitoring.	A system to centralize nationwide water quality data was established with the support of the ADB and has been operated by an office in charge of water quality control under the MPWT since 2010. The water quality control committee has been managing water quality standards. As of 2016, the government of Laos has prepared a guideline in line with the water safety plan of the WHO and plans to develop know-how and build human resources centering on the training center.	A ministerial order prescribes the drinking water quality standards for all water utilities. A total of 10 out of 13 public water utilities have water quality laboratories and have implemented water quality control that comply with the water quality standards. Other water utilities, including private ones, are mostly small entities and have not been able to implement appropriate water quality control because of budget shortage.	The organizations and equipment to implement water quality control have been well established and prepared. Although personnel ability has not been investigated, it can be confirmed that water quality has been controlled by a certain level of inspections.

2) B: Priority measures of international cooperation

The following priority measures were adopted in the study conducted last year: “addressing non-revenue water,” “water quality control (urban waterworks),” “rural water supply,” “measures against inorganic groundwater contamination,” “training of engineers,” improvement of business management,” “improved operation and maintenance,” and “public relations.” The findings in the study of Laos are also organized in accordance with these priority measures. For the purpose of summarizing the current situations, general conditions, and issues of water projects, the information obtained through last year’s study is compared with the study results of Rwanda, as one of the cases in Africa, on the basis of information collected via field surveys, as shown in Table 5.2.

It can be confirmed that recipient countries deliberate considerably on the measures for reducing non-revenue water in urban water supply, and the projects for developing the human resources necessary to implement such measures have started to show successful results. The systems to develop human resources for rural water supply have also been formulated at a rapid rate, and the systems to control water quality and information provision to customers have also shown progress comparable with the cases in Asia.

By contrast, the systems to maintain water facilities have not been sufficiently established, and there is room for improvements in management operations and water rate setting, which serve as the foundation of proper facility maintenance and management.

In terms of the assistance to Rwanda, the items to be considered in the water sector are as follows:

- There has been steady progress in the formulations of legal structures and administrative organizations related to water supply. The level of water quality control gives the impression that a relatively solid water quality control system has been established. Compared with Asian countries, Rwanda has a sufficiently efficient administrative mechanism. It can be said that a well-functioning governing system has caused Rwanda to come close to a threshold of economic growth.
- On the basis of the recognition that the measure for reducing non-revenue water in urban water supply is the most important challenge, Rwanda has entered into projects that implement the measure by establishing an implementation structure and educating local human resources with the support of Japan. These efforts are expected to bring results in the future. The measure for reducing non-revenue water can be established with assistance from Japan, which can make use of its experience in Asian countries where the measure has also been an important challenge.
- Furthermore, progress has been made in the formulation of a system to develop human resource development in rural water supply. The achievements in some aspects of the system formulation in Rwanda has been ahead of those in Asia because there is a large need for rural water supply in African regions. Thus, rural water supply in Rwanda needs to be addressed with further reinforcement. It is also necessary to promote continued efforts in preventing inorganic groundwater contamination.
- There is room for improvement in the formulation of a maintenance and management system. It has been generally recognized that Rwanda has shortages in ability and funds for the maintenance and management of water works. To efficiently execute the maintenance and management of water works, Rwanda needs to organize water works technologies, materials, and equipment suitable for the situations in Rwanda for the establishment of technical guidelines and standardization of materials and equipment, in addition to the reinforcement in the human resource development and fund acquisition. If the current uncontrolled situations of water works

technologies remain unchanged, it will be difficult to achieve efficient human resource and facility development.

Specific countermeasures include the evaluation and selection of the quality of technologies, materials, and equipment to be used for water works in Rwanda in consideration of the updated technological information on water works to compile the selected measures in the form of technical standards. This process will enable Rwanda to significantly improve maintenance and managerial abilities and to reduce the burden on acquiring knowledge of disorganized water works technologies, thereby achieving efficient human resource development.

Although having been in a growth stage with large reliance on donor investments and poor logistic development, Rwanda has inevitably needed to accumulate stocks more than necessary. However, it can be said that Rwanda is ready to go to the next stage. Asian countries may have similar issues, but Laos has still been in a stage prior to Rwanda, and Cambodia has not been in need of such accumulation of stocks because of past urgent and concentrated assistance after the civil war.

Japan can extend assistance to improve the above situations with its considerable experience in the operation of the standards and design guidelines for water works technologies. However, in doing so, it is necessary to pay attention to the fair evaluation of the effectiveness of the technologies unfamiliar to Japan, such as polymer coagulants.

- For the autonomous development of water supply, it is necessary to establish water supply management foundations and adopt water rates in consideration of the financial burden of capital investments. Rwanda is already aware of this issue and has taken necessary measures to achieve independent accounting. However, the level of water rates has not been sufficiently high and additional assistance is required to acquire know-how on autonomous management. Given that Asian countries have similar issues, and it is necessary to work out long-term measures to solve them.
- For the improvement in public relations, the local efforts observed through the field study seem to have achieved an effect on building solid relations with residents and to be in the level comparable to those in Asian countries.
- It is necessary to continuously promote human resource development to enrich human capital in the water supply sector. Rwanda has been well aware of the issue and is encouraged to continue the current measures to develop human resources. It seems that Japanese aid experience in Asia can be effectively used at least in Rwanda; therefore, further proactive assistance is desirable.
- From the viewpoint of building relations with other sectors than water supply, there is a point that the addition of the SDG perspective in international cooperation increases the importance of collaborative assistance with the medical sector, namely, universal health coverage. From the viewpoint of building relations with other countries, it can be said that considerable knowledge can be obtained by assistance activities in Rwanda because the division of roles among donor countries has been successfully made in Rwanda, which has attracted considerable attention as a hub of international cooperation in Africa.

Table 5.2 Current situations in each country and region from the viewpoint of priority measures

Priority measure	Focus point	Current situations in Rwanda and the African region	Experience and current situations in the Asian region and findings in Laos and Cambodia studies	Discussion
Addressing non-revenue water (urban waterworks)	Awareness of the importance of managing water supply distribution facilities can be evaluated based on whether non-revenue water countermeasures are correctly understood. To compensate for deficiencies in piping construction technologies, it is necessary to employ adequately trained full-time administrators and prepare training systems for construction work management and technical staff. (FY2006 Study).	(Situations in Rwanda) According to WASAC, NRW in Rwanda has been improved recently from approximately 70% in 2005[25] to approximately 35%, even in the case of urban water supply which shows poor improvement (but worse cases can be found in some areas in reality). To further reduce NRW to not more than 25%, JICA's technical cooperation program, Project for Strengthening Non-Revenue Water Control in Kigali City Water Network, has been implemented from 2016 to 2019. In addition, activities which have been conducted under the SusWAS project funded by the government of Netherlands and a private company include measures to reduce non-revenue water.[26] According to the JSR Review, Rwanda has focused on measures to reduce non-revenue water in the National Water and Sanitation Policy (NWSP), and measures are to be taken with the viewpoint of streamlining the operation of urban water supply. In particular, NWSP plans to improve NRW from 36% to 33% by introducing pressure reducing valves and replacing meters at 22 and 5,000 locations respectively in FY2017/2018.[27] However, the field survey conducted this time identified that the fundamental reason for the large NRW is an investment policy which has been relying too much on assistance without strategies and thereby having caused negative effects, such as insufficient maintenance of existing facilities, loss of consistency in the design policy among projects, and poor accumulation of technological asset. (Situations in Africa) JICA's technical cooperation programs have been conducted in Kenya, Nigeria, South Africa, and Tanzania for the establishment of guidelines, improvement in construction management capability, and human resource development through trainings. In addition, assistance programs combining dispatch of experts and grant aids have been extended to these countries. On the basis of the lessons learned through other cases including Asian ones, these programs have focused on the involvement of top management and counterparts in the programs to enhance sustainability of the efficiency and effects of the assistance.	(Situations in Laos) Previously, rough estimations of leakage rates were the only information available for judging NRW in Laos. However, owing to the recent technical assistance, there have been improvements in pipe management of many water supply state enterprises (WSSEs) and it has become known that their NRW has been approximately 25%. Except four areas, Vientiane, Luang Prabang, Savannakhet and Pakse, where water supply was started in the 1970's, water supply facilities are relatively new and have not been in urgent need of proactive leakage management. (Situations in Cambodia) The water supply associations have calculated NRW as differences between water distributed and meter readings. In those associations with insufficient flow meters, water distributed has been estimated from the operation hours of distribution pumps. Although measures to reduce NRW vary depending on the associations, their efforts to replace old pipes and implement leakage surveys have improved NRW to a recent rate of approximately 15%.	(Overall situations) As a result of continued appeal by Japanese experts, the importance of the need for reducing NRW has been widely recognized among overseas water utilities. In addition, series of measures to reduce NRW have been proactively implemented and achieved an effect with the systematic promotion of assistance to reduce NRW. Although the essence of non-revenue water countermeasures lies in comprehensive management of water distribution pressure, pipelines, and water supply equipment, some countries that have not benefited from Japan's cooperation and had a superficial understanding of the essence promote only the introduction of district metering areas. Thus, issues that need to be addressed, for example, ensuring accuracy of data, in these countries are also becoming clearer. It is necessary to implement cooperation in a manner that copes with indigenous situations while solving common issues regardless of the area. (Comparison of situations in Asia with those in Africa) The assistance in the reduction of NRW has been extended to many countries in Asia and Africa. Considering the years when the Japanese technical cooperation projects to reduce NRW were started in Kenya, Nigeria and South Africa are 2010, 2014, and 2017 respectively, the history of Japanese cooperation in African countries is short. In Kenya, a new project was started in 2016 as a succession of a 2010 project. Thus, it is necessary to observe the effectiveness and sustainability of the projects in each African country.
Water quality control (urban waterworks)	Even in many of the big cities with modern water supply systems, it is not always possible for residual chlorine to be detected at the end of water pipes.	(Situations in Rwanda) Based on water quality standards following the WHO's guideline, a large water utility like WASAC has established facilities and systems to inspect nationwide water quality management including rural areas. The water quality at pipe ends is inspected twice a week for turbidity, pH, and residual	(Situations in Laos) Knowledge provided by a JICA volunteer 10 years ago was the origin of the water quality monitoring in Laos. Currently, the awareness of thinking much of water quality management has been shared in the country through JICA's technical	(Overall situations) Because supplying safe water is the most important objective of water project, the assistance has proactively been extended to projects for improving water quality. In contrast, there are cases which require assistance in policy improvements, such as establishment of basic laws and

[25] According to the report by a trainee who attended a training in Japan.
[26] JICA, Basic Data Collection Study on Urban Water Supply Systems in the Republic of Rwanda 2017. The SusWAS, a public private partnership (PPP) company financed 60% by the government of Netherland and 40% by a private sector, has also conducted activities including measures to reduce non-revenue water for Kanombe and Remera branches in Kigali City.
[27] Joint Sector Review Report 2017/2018

	Experience and current situations in the Asian region and findings in Laos and Cambodia studies	Discussion
	cooperation project, and water quality in distribution pipe networks is checked across the country. The Ministry of Health has been in charge of controlling water quality. They have conducted regular inspections for 23 items. Although still in the process of preparation, the Ministry has been promoting water quality control based on a water safety plan (WSP). The establishment of water quality standards has also been in the process in parallel to WSP. (Situations in Cambodia) Water supply associations have been promoting water quality control by assigning persons in charge of water quality inspection in respective associations. Those associations which do not have laboratories or cannot inspect all of the 25 items outsource all or partial inspections.	water quality standards. Thus, it is necessary to cope with the needs for creating WSPs, capacity building for water quality management, stable supply of chemicals, and establishment of water quality standards based on regional characteristics. (Comparison of situations in Asia with those in Africa) In Asian countries, Japanese assistance has contributed to gradual implementation of measures to improve water quality. In Africa, while shifting from MDGs to SDGs, there has been growing awareness of the importance of improve water quality. Although there has been progress in the deliberation on the water quality improvement measures, they have not been implemented in most of the countries because high priority has not been given to them in contrast to water facility development.
	(Situations in Laos) The rural water supply in Laos has been under the jurisdiction of the Ministry of Health (MOH). MOH has also been in charge of promoting not only water supply but also sanitary facility development in rural areas. For rural water supply, MOH has applied 13 water quality management items to constructed facilities and monitored water quality at these facilities with a frequency that depend on the management items. MOH exercises jurisdiction over the construction management of water supply facilities and commissions their operation and management to villages. However, insufficient management of the facilities by villagers has been an issue. Donors from countries other than Japan have been active in assisting rural water supply. For example, a French international NGO has been implementing a program to promote and disseminate PPP projects for rural water supply.[29)] (Situations in Cambodia) The rural water supply in Cambodia has been under the jurisdiction of the Ministry of Rural Development (MRD). MRD commissions maintenance and management of water supply facilities to water and sanitation users groups (WSUGs) formed by communities. Many WSUGs have not been functioning well. It has been reportedly mentioned that maintenance funds to be collected from residents have not been stably accumulated because of low incomes of residents, insufficient financial management capability, lack of knowledge in facility maintenance and reserving funds for future replacement, and insufficient dissemination of guidelines. Thus, it has been necessary to establish fund management measures which are easily understandable by residents and transparent. Other reasons for poor functions of	(Overall situations) JICA projects have been playing the central roles in the construction of wells, development of small-scale water supply facilities and establishment of water management systems. Improving the supply of water in rural areas contributes to a greater extent to solving social issues than improving the supply of water in urban areas. A resident participation-type approach is required for overcoming water quality issues in villages. The community-driven development approach and the demand-driven management model are recognized as being effective. (FY2011 General Overview) In Asia, the international cooperation in the water supply sector has focused on activities to cater to needs for developing water supply facilities. The next step of the international cooperation is to deliberate strategies to diversify the scope of cooperation into the areas outside water supply regions so as to incorporate the improvement in sanitary environments, including rural water supply, which has been independently approached into the cooperation programs in the water supply sector. In contrast to many conventional activities to improve rural water supply, there have been increasing needs for urban water supply development in African countries. Thus, it is necessary to deliberate future actions utilizing the lessons learned from the conventional activities and the knowledge obtained through grass-root activities. (Comparison of the situations in Asia with those in Africa) As mentioned above, there have been more assistance programs implemented for rural water supply than for urban one in Africa. However, because rural water supply has been given low priorities in terms of budgets, insufficient

Priority measure	Focus point	Current situations in Rwanda and the African region	Experience and current situations in the Asian region and findings in Laos and Cambodia studies	Discussion
		Knowledge accumulated by JICA has been organized into a handbook on case studies of supplying water in rural Africa, and JICA has been assisting diverse rural water supply projects for constructing facilities, establishing operation and management systems, and reinforcing administrative capability. (2016 Report)	WSUGs include insufficient supply chains and low ownership among residents.[30]	ripple effects of assistance due to low priorities has been one of the major issues, similar to that observed in Asia.
Measures against inorganic groundwater contamination	It is necessary to monitor levels of arsenic and other substances by implementing measures, such as conducting water quality research, providing residents with hygiene training, and developing equipment to remove such substances. Global arsenic and fluorine probability risk maps have been published by a Swiss research institute called Eawang.[31] Refer to the map below.	(Situations in Rwanda) The quality of well water sources is inspected when wells are planned and constructed but no regular water quality inspections have not been conducted after the construction of wells. It has been confirmed that the groundwater in some areas in Rwanda has high fluorescent concentrations. In addition, it is reportedly mentioned that there have been risks of arsenic and mercury contamination in some areas. In NWSP, it has been pointed out that a majority of the problems related to water quality in rural water supply facilities are damage to wells and pipes as well as contamination of water resources. In addition, with awareness of the groundwater contamination, NWSP shows a policy direction that WASAC shall establish a concept of promoting water quality management in rural water supply and a guideline in collaboration with the Ministry of Health and RURA. WASAC commented that because they do not have enough knowledge with respect to the volume and quality of groundwater, they are grateful for possible Japanese assistance on how to manage and develop groundwater and how the development affects water quality and expect Japanese technical assistance in these fields.	(Situations in Laos) For rural water supply, MOH has applied 13 water quality management items to constructed facilities and monitored water quality at these facilities with frequency depending on management items. In some areas with arsenic contamination, water sources have been changed from groundwater to surface stream water. There is an opinion that there has been no issue related to arsenic contamination in urban water supply because a higher priority has been put on improvement in the coverage of urban water supply and the systems to control water quality remain insufficient.[32] (Situations in Cambodia) In Cambodia, people have been aware of the risk of arsenic contamination in groundwater. According to the research conducted by UNICEF, areas with high risks of arsenic are located along main rivers, such as Mekong, Bassac, and Tonle Rivers.[33]	(Overall situations) Proactive approaches have been taken to deal with arsenic issues and effective treatment technologies have been established even in developing countries. However, with the increasing population and demands for water supply, many countries have been facing difficulty in maintaining measures against arsenic contamination by relying on the awareness of residents. Thus, governments, NGOs, and research institutes have continuously taken measures to collect information on contamination distribution, introduce facilities to deal with contamination, and build consensus among residents. (Comparison of situations in Asia with those in Africa) The first case of arsenic contamination was discovered in Bangladesh and it has been known that similar issues can be generally found in Asian countries. In contrast, arsenic contamination has not been recognized as a major issue in Africa. This is considered to be not because of non-existence of the issue but because of the lack of information on the issue. As shown in the arsenic contamination map below, arsenic contamination has been found in African regions, and African countries have risks of arsenic contamination in water supply similar to that observed in Asian countries. It is necessary to conduct water quality tests for all constructed wells and provide measures to alleviate arsenic contamination in reference to cases in Asia if the detected levels of arsenic concentrations exceed water quality standards.

[30] JICA, Data Collection Study on the Water Supply Sector in Cambodia, 2010
[31] Web page of Eawag: http://www.eawag.ch/en/research/humanwelfare/drinkingwater/wrq/risk-maps/
[32] JICA, Data Collection Study on the Water Supply Sector in Laos, 2016
[33] Webpage of UNICEF: https://www.unicef.org/cambodia/As_Mitigation_in_Cambodia_2009.pdf

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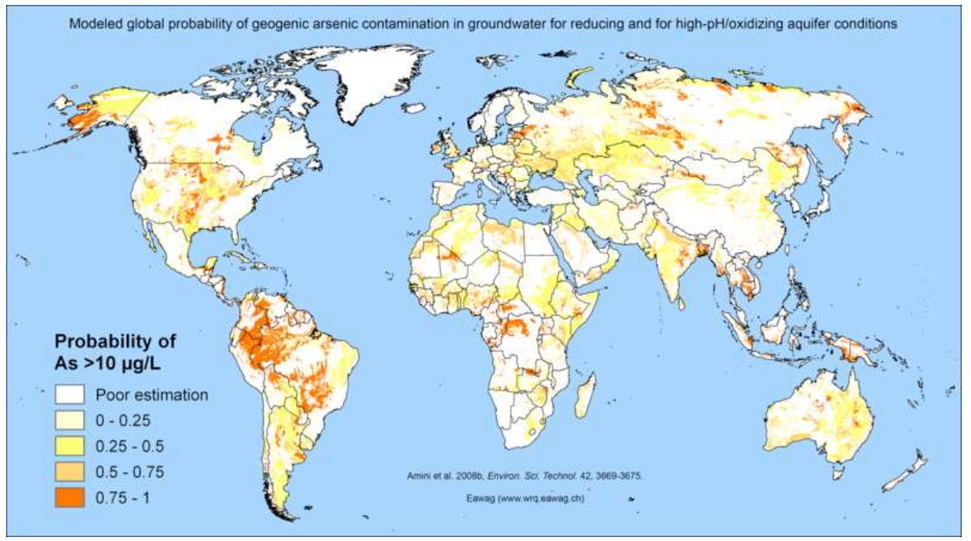
<tr><td></td><td colspan="4"> 

Global arsenic and fluorine contamination map</td></tr>
<tr><td>Development of human resources</td><td>It is necessary to develop technical human resources who understand water supply technologies. To ensure safe water supply, it is important to develop personnel who understand water purification technology, in particular, managerial-level personnel who can be responsible for managing all processes organically.
It is also necessary to improve technical skills of contractors by strengthening construction supervision, introducing construction evaluation systems, and providing training programs.</td><td>(Situations in Rwanda)
The Japanese corporation has been extended to Rwanda through participants in technical cooperation programs related to reduction in non-revenue water and rural water supply as well as periodic trainings in Japan.
NWSP also mentions needs for capacity building, particularly at the level of districts, and the importance of the implementation of assessments as well as technical supports to districts of Rural Water Services in the WASAC. The 2017/2018 joint sector review also focuses on human resource development by pointing out the establishment of a training center for rural water utilities, including private companies, and the development of training tools as priority items in 2017/2018.

(Situations in Africa)
Based on the expected acceleration in the population growth and population concentration into urban areas in the entire African region, enhancement of abilities to manage urban water supply will be of increasing importance in the future.
Technical transfer with respect to repair of wells (including well construction management) and measures against non-revenue water have been implemented through JICA’s technical cooperation and trainings in Japan. Assistance for human resource development has also been</td><td>(Situations in Laos)
Although the Ministry of Public Works and Transport explained that they have promoted HR strategies and system development under ADB programs, no tangible outcomes have been produced. It cannot be said that human resource selection and development has been properly implemented.
In WSSEs, human resource development has been made through OJT. The Chinaimo water treatment plant of the Vientiane Capital WSSE has an attached training center which provides training for the staff of WSSEs in the country. Under a human resource development program started in 2008, newly hired staff and regional WSSE staff have been trained here in accordance with a state directive. JICA also has extended technical cooperation projects focusing on human resource development.

(Situations in Cambodia)
JICA has extended continuous assistance in the project for human resource development for water supply systems since 2003.
● Phase 1: 2003–2006
Enhancement of water quality control and water supply capacity in Phnom Penh WSSE
● Phase 2: 2007–2012</td><td>(Overall situations)
JICA’s technical cooperation had high expectations from recipient countries because other countries and donors have invested into technical human resource development to a lesser extent than Japan. Japanese assistance for human resource development has been centering on technical cooperation projects with operation, maintenance, and management of water purification plants as themes.
In addition, Japan has extended assistance for comprehensively developing technical human resources through training in Japan and assistance to training centers in accordance with the levels of education and water supply in recipient countries. Japanese past patient efforts have started to achieve the effect.

(Comparison of situations in Asia with those in Africa)
In Asia, Japanese assistance for human resource development has focused on the establishment of training centers and implementation of training. In particular, the training center in Thailand plays a central role in developing human resources for water supply services in Southeast Asian countries. This human resource development can also produce secondary effects (FY2014 Study), and there has been a case where staff from Phnom Penh WSSE go to other countries to give lectures.</td></tr>
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		implemented through the soft components[34] in collaboration with grant aid projects with respect to the development and extension of water purification plants.	Enhancement of water quality control and water supply capacity in WSSEs in eight regional cities ● Phase 3: 2012–2018 Enhancement of management capability in WSSEs in eight provincial cities	In Africa, although there have been cases to train counterparts of the technical cooperation projects for Sudan and Burkina Faso in Morocco and Benin, respectively, the degree of integration of training activities among recipient countries has not been as intensive as in the cases in Asia. It is necessary to examine the future direction of human resource development which can be implemented with limited resources on the basis of utilization of existing facilities, including the possibility of south–south cooperation to accept African trainees for training in Asian countries. There was a case of training a counterpart of the technical cooperation project for South Sudan during training in Phnom Penh. It has been reported that the south–south cooperation can create a good impression on both countries which offer and receive trainings.
Improvement of business management	It is advisable for an independent accounting system to be adopted to maintain water supply systems. To that end, the following are required: thorough record keeping and accounting to clarify costs, fair and equitable water rate systems, and appropriate water rate collection. (FY2014 Study).	(Situations in Rwanda) Currently, water rates are calculated on the basis of standard rates using a formula decided by MININFRA and cover only operation and maintenance costs including those for salaries of staffs, chemicals, operation and maintenance of facilities, electricity, logistics, and VAT. Capital expenditures (CAPEX) have been covered not by the water rates but by public funds. Water rates are to be revised in consideration of purchasing power and financial conditions. Although WASAC has been operated on the basis of an independent accounting system and achieved independency of accounting, it has been in the need of government subsidies not through MININFRA but through the Ministry of Finance and Economic Planning.[35] Thus, WASAC has managed its independency of accounting within the constraint of the current water rate system. However, unable to allocate capital expenditures from its water revenue, WASAC basically needs to rely on assistances for promotion of water supply and is facing a wall of fund shortage limiting investment for maintaining operation. In contrast, one of the policies stipulated in NWSP aims at enforcement of appropriate water rates and efficient water management to achieve independency of water	(Situations in Laos) In Laos, prefectural governors are to approve revisions in water rates after deliberation in prefectural assemblies (the Office of the Prime Minister in the case of Vientiane Capital), and WSSEs have no authority to decide water rates. In addition, upper limits are set for fare hikes. Respective WSSEs manage their own water accounts using accounting systems, but water rates are not in a level to cover capital expenditures. The government intends to find funds for new equipment and facilities, including for refurbishing of existing pipes, by increasing the water rates. (Situations in Cambodia) In the phase 3 of its project for human resource development for WSSE in eight provincial cities, JICA has been assisting the clarification of issues to make incomes and expenditures transparent and to improve management and establishment of measures to address the issues since 2012. The assistance also includes introduction of a uniform accounting system, KPI, and benchmarking. Through the assistance, WSSEs in all eight cities have moved into the black after depreciation on a single-year basis since 2015.	(Overall situations) A JICA handbook on managerial human resource development has been utilized together with a handbook on conducting capacity assessments for the urban water supply sector and water supply utilities in developing countries (JICA, 2010). JICA analyzed perspectives concerning the organization and analysis of the water supply service environment based on the following three aspects: governance, personnel system, and financial base. (FY2014 Report) There has been worldwide recognition that achieving full-cost recovery in the true sense of the term, including costs for facility construction, is difficult only with water rates. In addition, there has been a persistent belief that water rates need to be held down for guaranteeing basic human rights. However, there has been no case of public funds which can sufficiently cover all necessary costs for developing and maintaining water facilities. In many cases, water utilities with low water rates have not been able to provide sufficient water supply service. (Comparison of situations in Asia with those in Africa) The water supply in Asia and Africa have a common problem that low water rates set without consideration of covering capital investment costs have been a fundamental

[34] Technical cooperation implemented for the purpose of improving the capability of recipient countries to appropriately operate, maintain, and manage facilities and equipment constructed and delivered under the Japanese grant aid projects only with the local resources. It is necessary to complete such technical cooperation by the completion of the construction or delivery of equipment.
[35] JICA, Basic Data Collection Study on Urban Water Supply Systems in the Republic of Rwanda, 2017

		utilities. Specifically, NWSP mentions that WASAC is to establish a guideline for setting water rates in rural water supply.		cause of shortages in budgets to maintain water quality. In Cambodia, however, there is a case of challenging the problem by introducing a system to provide licenses to private water service companies. It is necessary to share knowledge of cases successful in solving this problem and apply this knowledge to other countries regardless of the region.
Improvement of operation and maintenance	The importance of operations and management is sometimes overlooked. Given that there are limits to self-help efforts that development countries can undertake, more in-depth support needs to be provided.	(Situations in Rwanda) According to a field survey, one of the reasons for prolonged formulation of the water facility management system is considered to be inconsistent investment in water supply. There is no consistency in technologies used in water supply systems, for example, a water purification plant with different types of treatment systems and pipelines with no consistency in their materials and equipment. Under these circumstances, technologies to be developed for the maintenance of water facilities will be very complicated and create a drag on information management and human resource development. In addition, the effort to introduce efficient management, including asset management, and water rate setting by improving the web information management system (WASH MIS) will not produce an effect with the inconsistency issue above left untouched.	(Situations in Laos) Because facilities have been poorly recorded and drawings have been poorly organized, information on previous construction and maintenance history is not sufficient. JICA's technical cooperation project has been in progress to improve these situations on a nationwide scale. Considering that almost all pipes were installed in the last 20 years, there are very few cases of deterioration but some cases of malfunction. (Situations in Cambodia) Owing to the JICA project for human resource development implemented for improving the operation and maintenance of public water supply, there has been accumulation of records and data on facility operation and inspections, construction, and water leak survey results.	(Overall situations) The JICA's technical cooperation projects have been implemented for reinforcing abilities to maintain and manage water supply. Although there are some cases that produce effects, systematic methods involving technical and record management have not been established yet in most of the cases. However, as demonstrated in Laos, a thorough enforcement of record management has an effect of motivating autonomous improvement in operation and maintenance. (Comparison of situations in Asia with those in Africa) Considering literacy rates of Laos, Cambodia, and Rwanda of 79.9%, 77.2%, and 70.5%, respectively,[36] a thorough enforcement of record management can be achieved even in Rwanda and other African countries and similar consequences as that in Laos can be expected. It is necessary to gain understanding of the people in these countries for the importance of management through long-term technical cooperation on an annual basis.
Improvement of public relations with residents	Public water utilities need to establish good relations with residents. It is also important that public utilities mention effectiveness of assistance from Japan when they establish relations with the residents.	(Situations in Rwanda) A call center has been in charge of customer relations. Other publicity activities have been made through television and radio broadcast as well as SNS. (Situations in Africa) In Malawi, a community radio broadcast has been used for the publicity of the operation and maintenance of well facilities and enlightenment of maintaining water quality as well as sanitation through JICA technical cooperation. A publicity manual has also been created.	(Situations in Laos) Some WSSEs have sent out letters indicating information on water charges, held classes on waterworks, conducted questionnaire surveys for customers, received complaints through call centers, and collected information. (Situations in Cambodia) Phnom Penh and Siem Reap WSSEs have placed advertisement using blank spaces on water bills. Some WSSEs also place explanation boards of a water rate system at their pay stations.	(Overall situations) Publicity activities for end users in respective countries need to be executed with the following two objectives in mind: benefit from international cooperation and facilitation of water utilities' operation. It is necessary to deliberate effective means for publicity depending on levels of understanding of people for the benefit of international cooperation. (Comparison of situations in Asia with those in Africa) Publicity activities have been executed with domestically available means in some areas in Asia and Africa. In terms of promotion of Japanese contribution, it can be made through the presence of Japanese people during the

[36] UNDP, Human Development Reports, 2016; http://hdr.undp.org/en/2016-report

				implementation of technical cooperation projects but requires devices, such as dispatching of W-SAT, to make it continuously effective even after implementation of the projects.
Improvement of public relations with other countries	It is necessary to ascertain how well Japan's cooperation activities are known and recognized, particularly in partner countries. (FY2015 Study) JICA, as a whole, is proactively conducting comprehensive public relations activities, and they feature in the water supply sector as well.	(Situations in Rwanda) Because Rwanda is one of the African countries that is cooperative to Japanese assistance and is expected to be a promising recipient, extending assistance to Rwanda has an aspect of competition with other donor countries. The SDG center, which was completed in September 2016 and has started to provide higher education since this year, exercises jurisdiction all over Africa. It is highly recommended for anyone who intends to participate in international cooperation in Africa to use the center. Transmission of information on Japanese international cooperation activities in all fields, including water supply to African countries, has been made on the occasion of TICAD and the African festivals.	(Situations in Laos) Although their sizes are small, donor countries and international agencies have promoted development assistance projects in Laos. (Situations in Cambodia) Phnom Penh WSSE has been working on a program to extend technical cooperation to other countries in collaboration with international donor agencies.	(Overall situations) The counterparts of technical cooperation show their gratitude for highly practical Japanese cooperation, but evaluations of the Japanese corporation by end users are unknown in most cases. After reviewing how public relations should be handled in terms of international cooperation based on the following three perspectives, suggestions have been made regarding the basic structure and measures: recognition in international society, recognition in partner countries, and recognition of ODA projects in Japan. (FY2015 Report) It is necessary to consider new support for measuring the effectiveness of public relations and conducting quantitative evaluations based not only on the direct effects of water projects but also on their ripple effects on health and public sanitation, such as the reduction in infant mortality rates. It is also necessary for recipient countries to first gain recognition by participating in international conferences, seminars, and forums and then to take measures for higher public relation effects, such as being hosts of international conferences. (Comparison of situations in Asia with those in Africa) In Asian regions, there are some cases where confidential relations with recipients of technical cooperation have been fostered through the long-term approach with participation of municipal governments. In contrast, considering reduced assistance in rural water supply, which has long been implemented in African regions, fostering public relations is expected to get more difficult from the viewpoint of continuity. Thus, it is desired to continuously extend assistance to increasing number of projects to develop urban water supply and foster relations through the projects.

3) C: Expansion to regions with weak ties

According to the above comparison of situations in Rwanda, Laos, and Cambodia in terms of priority measures, there has been no significant comparative superiority or inferiority among countries despite minor differences. Thus, there is nothing special about extending assistance to Africa.

In contrast, on the basis of opinions of committee members, the following items can be considered as regional differences that require consideration when extending assistance to Africa: (1) natural conditions (the African continent is geographically longer in the north–south direction than the Asian continent and thereby has diverse natural conditions, including arid and semi-arid zones, groundwater levels in foundation rock areas are generally deeper in Africa than in Asia, and allowable pumping quantities are smaller in Africa than in Asia), (2) social conditions (differences in economic growth rates and population density), (3) influence of European water majors (the influence of European water majors is large in Africa than in Asia), (4) history of keeping relationship with Japan, and (5) distance from Japan (causing high travel costs) and languages (existence of French- and Portuguese-speaking regions).

In essence, there is no significant difference in issues and practical measures regarding water sectors between Arica and Asia. Thus, there are many fields in Africa to which the experience obtained through past Japanese technical cooperation in Asian countries can be applied, and there is a tremendous scope in Africa for which Japanese assistance can evolve.

Chapter 6 Recommendations on Activities to be Performed in the Future

This chapter summarizes the information given thus far and extracts issues to be addressed in the future, which are organized by item (A, B, and C).

1) A: Assessment of conditions in each country by keeping in mind the indicators for SDGs

Previously, we have selected aid receiving countries mainly on the basis of available data. In the future, the importance of SDGs, which were established as a yardstick, will be increasingly recognized. There seem to be a lot of issues remaining on data collection for grasping the conditions in different countries, and the activities to be conducted in the future to collect and use information include the following:

- To clarify the relationship between SDGs and Japan's international cooperation, baseline and end-line surveys should be conducted, and data accuracy should be increased. Furthermore, active involvement is needed in information collection, sharing, updating, etc.
- Introduce SDGs together with Japan's international cooperation in the water supply sector to allow not only those engaged in projects but also the general population to deepen their understanding of such cooperation. Create and provide easy-to-understand information for not only experts but also other ordinary people and introduce Japan's activities by using the information. Furthermore, consider using such information in school education and other opportunities via websites or by other means. For the status of monitoring in different countries, it is desirable that not only data but also previous discussions by JMP, up-to-date survey status, and information reliability should be shared. Such information must be updated periodically.
- Among the indicators of SDGs, Target 6.1 is basically the numerical value that indicates the result of viewing water and sanitation status from the standpoint of residents. To improve the status, it is important to grasp the conditions of Targets 6.4, 6.5, 6.a, and other intended targets to ensure water supply and sanitation in all countries. The relationships of these targets also need to be analyzed to match needs to seeds. In an international cooperation survey conducted in 2014, the method of comparing the conditions in different countries in the three aspects of governance, personnel systems, and financial bases was considered. We may be able to apply this method to analyze relationships with the indicators of SDGs.

These activities are related to Target 6-1, whereas SDGs place importance on coordination with other goals and sectors.

Goals related to the water sector include Goal 1, which is related to poverty reduction. It mentions "access to basic services" in SDG 1-4, which can be related to water supply. Also, it is mentioned that not only the Goal 3 which is related to public sanitation, but also Goal 4 and 5, which is related to education and gender, have a connection with water sector considering the issue of water drawing in rural and suburban areas in Africa.

Goal 13, which is related to climate change, is also strongly related to water supply in that water security is important. Thus, it is important to provide support in the water sector in a way that enables

coordination with and contribution to other sectors. We need to discuss the direction of cooperation with that in mind.

2) B: Evaluation of needs and activities in the water and sanitation sectors

A survey was conducted on the actual conditions of international cooperation in the water sector of Rwanda. From this survey, it was found that international cooperation activities in high-needs fields, such as countermeasures against NRW in urban water supply, support to rural water supply, and human resource development, have already been started.

On the other hand, it is assumed that we have almost reached the stage of supporting the country in establishing the management thought of recovering construction and maintenance costs for waterworks facilities from water rates (the inability to do so is considered the root cause of on-site issues) or the technological thought of applying different technologies depending on the circumstances of the country.

Japan has its own history of water supply. By considering what efforts are needed to improve the conditions of Rwanda in light of this history, we can provide experience-based support. On the other hand, until we tackle the serious problem of our lack of know-how in technologies or practices that are not in widespread use in Japan, we cannot meet the technical needs of Africa and other foreign countries.

In order for the Japanese government to export infrastructure and encourage private companies to support these countries as part of its policies, close surveys should be conducted on water supply technologies around the world and water supply technologies should be obtained, including those not popular in Japan, from around the world.

3) C: Expansion to regions with weak ties

As mentioned in A and B above, we overlooked the circumstances of Rwanda to find differences in international cooperation between Asia and Africa; generally, the obstacles that we will face in Africa is not that significant.

Experts and consultants working in Rwanda say that a positive atmosphere can be felt from the ability and eagerness of the country's government officials, and it is easy to forge ahead with a project there even though there are a lot of issues to be addressed.

Many think that efforts in the water supply sector are only related to SDG 6, but it is important to recognize that water-related issues also play a role in addressing other subjects. In this respect, the UHC is the starting point of cross-sectoral cooperation and should make efforts more actively.

In the survey conducted in the last fiscal year, it was controversial whether limited resources should be used more for the water supply sector in Africa. However, considering the government's stance, there is no question that support to Africa is important for Japan's international cooperation.

Looking at the conditions of Africa by country or region, there are population density-related problems and shortages of water resources. To grasp the conditions of the whole African continent, we need to collect a wider range of information.

Some comment that Rwanda is special in Africa and other countries are currently in more difficult conditions. Rwanda can be a starting point for carrying out activities in Africa, and water service providers or water-supply-related companies should gain experience in performing projects in this

country first to decrease the psychological barrier to entering Africa and consider support that takes advantage of their experience accumulated in Asia.

4) Summary

Looking at A, B, and C highlighted in this survey from a higher perspective, it can be said in conclusion that to further promote international cooperation in the water supply sector in the future, it is important to grasp and better understand the current water supply conditions around the world and spread this information widely.

Specifically, we need to make effective use of the indicators of SDGs as a yardstick and sort out not only the water and sanitation conditions in different regions but also conditions in sectors other than SDG 6 first. Thereafter, surveys can be conducted on business environments in different countries and on water and sanitation technologies used around the world on the basis of the method proposed in the international cooperation survey conducted in 2014. Effective publicity activities can be performed by applying the results of the international cooperation survey conducted in 2015. It would be also important to publicize the results of international cooperation by water service providers or other parties, as well as the overseas aid by Japanese companies. Finally, these efforts will help address the long-standing issue of securing and developing human resources who participate in overseas projects.

Furthermore, on the basis of information obtained and via human resource development, we should focus not only on technical issues but also on the issue of governance and other upstream issues. Efforts should also be made toward sustainability in the water sector around the world.