

Republic of Malawi Project for Strengthening the Capacity of Non-Revenue Water Reduction for Lilongwe Water Board (LiSCaP)

- Building Sustainable Non-Revenue Water Measures Focusing on capacity development of staff -

March 2022



Chapter 1. Project Background and Challenges

The population growth rate of Lilongwe City is at 3.8% (2018 Malawi Population and Housing Census) compared with a national average of 2.9% leading to an increase in water demand in the city. The average water supply hours per day by the Lilongwe Water Board (LWB) was 24 hours in 2010, but this reduced to 18 hours in 2015 due to the increase in demand. At the same time, the non-revenue water (NRW) ratio was as high as 36% in 2015 (LWB Strategic Plan 2015-2020) which included unbilled water volume attributed to water leakages by aging water supply and distribution pipes, and faulty meters.

In view of the NRW levels cited above, LWB embarked on a campaign to deliberately implement activities aimed at reducing the NRW ratio to a target rate of 28% by 2020 with focus on using limited water resources efficiently. The target was also specified in the “LWB Strategic Plan 2020-2025,” and LWB continues implementing NRW reduction activities. On the other hand, the activities implemented by LWB were limited

to measures against immediate problems, and LWB was in need of assistance in formulating more comprehensive, effective and sustainable NRW reduction strategies and improving its technical capacity. In the context of these circumstances, JICA commenced “The Project for Strengthening the Capacity of Non-Revenue Water Reduction for Lilongwe Water Board” (hereinafter “the Project”) in June 2019.

The Project aims to implement NRW reduction activities in the target area efficiently and effectively under the NRW reduction strategy to be formulated. JICA experts support NRW reduction activities throughout OJT to strengthen technical capacity at four selected pilot District Metered Areas (DMAs). Knowledge and lessons learned from those activities are shared and disseminated not only within LWB but also to other water boards in Malawi.

During the return of JICA experts from Malawi to Japan due to the COVID-19 pandemic, support for on-site activities from Japan was continued using an online conference system. The experts also provided additional

assistance, including the installation of residual chlorine control, rehabilitation of KIOSKs, and the formulation of a business continuity plan (BCP) focused on the COVID-19 pandemic. However, the delay caused by COVID-19 pandemic, necessitated the extension of the project duration to April 2024.

Chapter 2. Approaches to Solving Challenges

(1) Overall Approaches

The overall project approach is to apply soft-component/measures of (NRW) reduction activities with a focus on strengthening the organizational capacity of LWB towards addressing the challenges of NRW reduction, while aiming at ensuring sustainable implementation of the proposed activities. The Hard-component/measure had been taken through the provision of equipment for NRW reduction by Japanese Grant Aid project and support from other donors such as the World Bank and the European Investment Bank (EIB). This support usually focuses on infrastructural development such as the rehabilitation and expansion of water supply facilities.

As shown in Fig.1, the international development partners are taking problem-solving approaches/measures coordinated among partners, emphasizing on the capacity and support rendered.

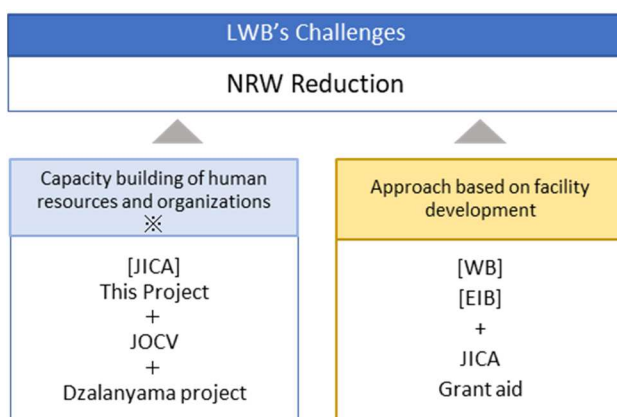


Fig.1 Overall framework of problem-solving Approaches coordinated among partners

※< Capacity building of human resources and organizations>

1) LiSCaP

To strengthen the LWB's organizational capacity through providing technical assistance by JICA experts. The areas supported include formulation of NRW reduction strategy, technical transfer of NRW reduction activities, awareness-raising and dissemination of knowledge sharing.

2) Collaboration with Japan Overseas Cooperation Volunteers (JOCV) while facilitating the awareness-raising of NRW reduction targeting residents.

3) Collaboration with JICA's Technical Cooperation Project, "The Project for Conservation and Sustainable Management of Dzalanyama Forest Reserve." by strengthening the capacity of the Dzalanyama Forest Reserve management team in water and forest conservation in Lilongwe City.

(2) Specific Approaches

1) Output 1: Revision of NRW Reduction Strategy

a. Outline

The objective of Output 1 is to strengthen LWB's planning capacity for NRW reduction. Specifically, the JICA experts assist LWB in grasping the current status and challenges in the existing NRW reduction strategy, identifying the future direction, and revising the existing strategy by applying the PDCA cycle covering monitoring, evaluation, and revision.

The results and lessons learned are extracted for implementation of the NRW reduction activities under Output 2 and are used actively for the revision of the existing strategy to enhance the effectiveness of the revised Strategy.

b. Ensuring Sustainability through Linkage with Management Strategy and Budget Allocation

The NRW Reduction Strategy is linked with the highest level management strategy, "LWB Strategic Plan 2020-2025," and annual budgets, as shown in Fig.2, to ensure sustainability. The annual budget

allocation will also ensure human resources development and organizational strengthening for the sustainable implementation of the NRW reduction strategy.

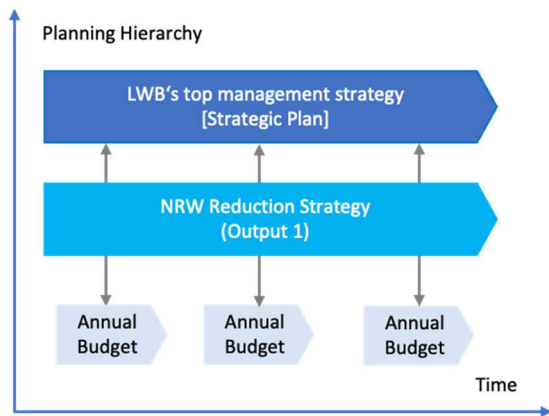


Fig. 2 Linkage among Strategic Plan, NRW Reduction Strategy and Annual Budget

2) Output 2: NRW Reduction in Pilot DMAs

Four pilot DMAs with different characteristics were selected to enhance the NRW reduction activities currently implemented by LWB. In Output 2, in addition to improving the NRW reduction activities currently being carried out by LWB, NRW reduction techniques suitable for local practices and topography/geology will be adopted through activities in DMA. For preparation of reduction activities, to calculate an accurate NRW ratio at the pilot DMA, preparation work would be carefully carried out, such as confirming hydraulic isolation in the DMA and customer lists to measure water consumption volume through billing data.

To firmly and sustainably put NRW reduction activities into practice at the LWB, OJT is applied to enhance the capacity of skills/techniques, such as meter replacement and leak detection and capacities related to NRW reduction processes as pre- and post-monitoring.

Each activity's effectiveness in the DMAs is evaluated to take reasonable and sustainable measures for NRW reduction contribution in LWB. Specifically, when the activities in the first DMA are completed, each activity is evaluated, including cost-benefit analysis, as shown in Fig. 3 and then the evaluation results are used to identify the effective activities for implementation in the

subsequent DMAs. The evaluation of DMA activities is conducted on a commercial and physical loss basis respectively and will be reflected in activities in the next DMA.

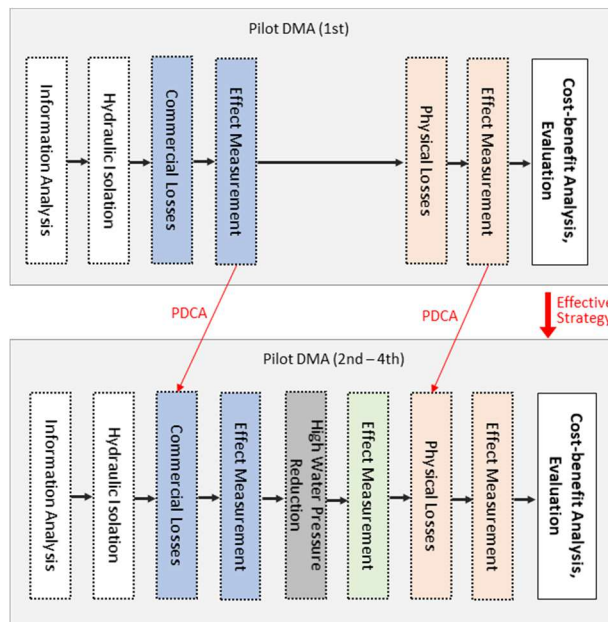


Fig. 3. Flow of NRW Reduction Measures at Pilot DMAs

3) Output 3: Capacity Enhancement for Sharing and Disseminating LWB Knowledge and Experience

Output 3 is to enhance LWB's capacity to share and disseminate the knowledge and experience for the NRW reduction acquired in the activities under Outputs 1 and 2 within LWB and other water boards in Malawi and abroad. It is expected that these efforts will lead to the capacity enhancement of other water boards in Malawi and abroad.

The specific activities under Output 3 include formulation of a knowledge sharing strategy on NRW Reduction, and the enhancement of LWB's capacity to share and disseminate the NRW reduction knowledge and experience within LWB staff, with other water boards in Malawi and also sharing the information with the countries in the African region and the world.

As shown in Fig.4, the NRW Division of LWB takes a leading role in the dissemination of knowledge sharing and promoting it within LWB. The NRW Division also actively promotes knowledge sharing activities with

other boards in Malawi and overseas.

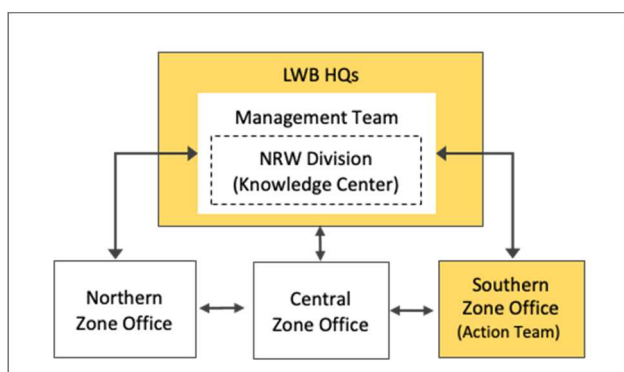


Fig. 4 Knowledge Sharing System within LWB

The Project assists LWB in developing the “awareness raising action plan for reducing NRW” to facilitate customers’ understanding and promote their participation in reporting leakages and illegal connection, in parallel with disseminating information and sharing knowledge on NRW reduction activities.

The action plan implements awareness raising activities for customers, including resident's meeting, water facility tour, and the distribution of awareness raising leaflet. Through these activities, the Project assists LWB in enhancing the implementation capacity of conducting awareness-raising for customers on NRW.

4) Capacity Assessment (CA)

Capacity assessment (CA) on NRW reduction is carried out to grasp the capacity level of LWB’s counterparts (C/Ps) and to reflect the results gained to LWB’s daily work and human resources development plan.

The Project identifies CA items to grasp the capacity level of LWB at the baseline, the mid-term and the end-line review periods.

Chapter 3. Results of Project Implementation to Date

(1) Output 1: Mid-Term Review and Revision of NRW Reduction Strategy

The existing NRW Reduction Strategy was reviewed and revised through a workshop along with the formulation of the LWB Strategic Plan 2020-2025. The Project facilitated the participation of LWB staff

members in the revision process of the existing strategy, which led to a deeper understanding of the revised strategy by the LWB staff members.



Photo 1: Workshop of NRW Reduction Strategy Revision

The revised NRW Reduction Strategy (2019-2025) identified 44 activities, a reduction from 85 activities in the previous version to align it with the Strategic Plan. The Brief Notes (outline of activity) were developed for each of the 44 activities to clarify the detailed actions, implementation schedule, and the responsible division/office in the LWB.

In addition, the revised Strategy clarified the monitoring and evaluation processes of implemented activities.

It also specified the timing of monitoring and evaluation and allowed the annual evaluation for its revision based on the evaluation results. These points ensure the mechanism of maintaining the Strategy updated constantly.

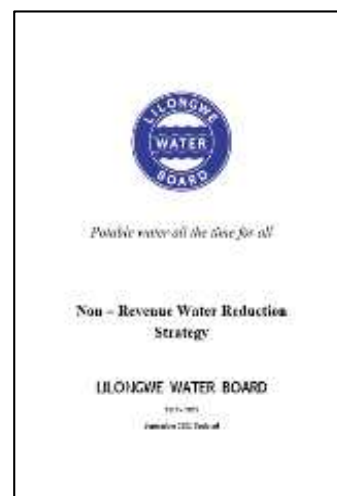


Photo 2: Non-Revenue Water Reduction Strategy (2019-2025)

(2) Output 2: Cases of NRW Reduction with the Establishment of DMAs

a. Preparation Work of DMA Activities

The four pilot DMAs were selected with eight criteria, ensuring all necessary technical elements and knowledge to be transferred through the pilot activities and disseminated to the entire.

Since it was important to establish the implementation process of accurately verifying the effectiveness of pilot activities on NRW reduction at the pilot DMAs, the Project ensured that the preparation work followed the flow of DMA establishment specified as shown in Fig. 5. Also, the SOPs for respective stages were developed to promote the C/P's understanding. When LWB staff and JICA experts conducted DMA validation at the first pilot DMA, it was found that the boundary of the DMA needed to be modified.

LWB is taking the initiative in establishing the second DMA. They also calculate the NRW ratio for the first pilot DMA accurately by keeping the measured period consistent with daily bulk meter reading and customer meter reading.

Hereafter, the JICA experts will assist in reviewing SOPs, establishing the process of report preparation, and disseminating the DMA establishment method in other zones of LWB.

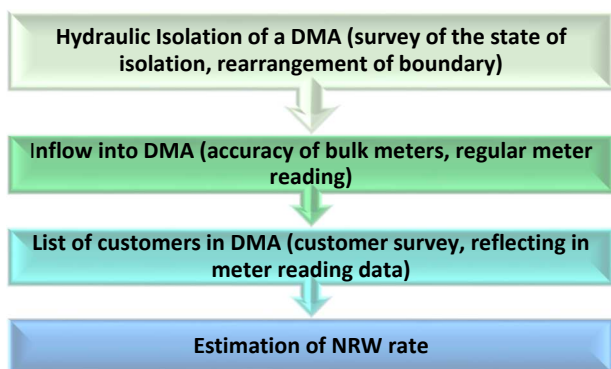


Fig. 5 Workflow of Preparation Work

b. Measures against Commercial Losses

Meter Replacement

In the first DMA, all customer water meters were replaced and meter accuracy testing was conducted. The main purpose of these activity was to grasp the trend of

customer meters' condition in the entire service area of LWB judging from the results of sampling and to propose the NRW reduction measures in the future.

Fig. 6 reveals that the faulty meters accounted for 12.2 % of the meters out of 278 samples, directly contributing to NRW reduction. The active meters accounted for 87.8% of the samples, and their average error rate was -3.8%. Therefore, this result was interpreted that the meters were relatively in good condition. On the other hand, the meters whose error rate was large and required replacement accounted for 20.9% of the samples; therefore, it is important to take measures against these meters.

The JICA experts will assist LWB in effective meter replacement work in the remaining DMAs, taking into account its cost-effectiveness conducted in the first DMA.

Item	Number	% by sample meter	Error %
Number of sample meter	278	100	-
1) Faulty Meter (Unmeasurable)	34	12.2	-
2) Active Meter	244	87.8	-3.8
Average Error	-5% ≤ X ≤ 5%	186	66.9
	-10% ≤ X < -5%, 5% < X ≤ 10%	28	10.1
	X < -10%, 10% < X	30	10.8

Fig. 6: Percentage of Faulty Meters and Meter Error of Active Meters

Data Handling Errors of Meter Reading

The data handling errors occur in the situations shown in the table below. LWB recognizes these errors as a serious problem as it translated into an NRW ratio of 9.7 % (March 2021).

The Project plans to develop a tool to detect data handling errors by classifying the detailed errors by cause and take measures to improve the meter reading process in the situations below.

1	A situation where incorrect water consumption is recorded in the meter reading and used in settling the amount of revenue water
2	A situation where a meter reader does not read a meter
3	A situation where a meter is faulty and not readable

Illegal Connections

Through a resident reporting campaign, the number of reports from customers on illegal connections has increased significantly. As a different approach, the Project will support introducing an inspection for illegal connections in the meter reading process and awareness-raising activities for residents from the perspective of prevention.

c. Measures against Physical Losses

Leak Detection

The leak detection activities using the acoustic methods at each customer house have been carried out and the leak detection system, including pipe repairing responding to the found leakage, was established. After the leakage repair, monitoring was conducted to measure the effect of the leak detection.

The leak detection team was formed with the selected caretakers from the Southern Zone, Northern and Central Zone Offices. This team composition has enabled all three offices to learn the relevant skills and promote knowledge sharing among themselves.



Photo 3: Training on Leak Detection

The team visited every house in the first DMA and examined whether the sound of suspected water leakage could be heard with a listening stick. At the same time, the experts provided an OJT on the visual inspection of surface leaks (visible leakage) and identification of underground leakage points (invisible leakage) with a leak detector. Through these activities, the team detected 55 water leakages (50 visible and 5 invisible), which reduced water losses by approximately 4.0 m³/h.

Pipe Repair

In the first DMA, JICA experts proposed a method of recording leakage repairs, and C/P has put this activity into practice. The accumulated leak repair records are used to analyze the trend in the occurrence of leaks, classify factors for causing leaks, and identify frequent leaks. JICA experts also raised plumbers' awareness of the pipe leakage repair work and improvement through workshops and OJT in DMA. In addition, the experts will assist LWB in establishing a system that enables the LWB staff to work safely with AC pipes and dispose them off at appropriate storage sites.

(3) Output 3: Capacity Enhancement for Sharing and Disseminating LWB Knowledge and Experience

Knowledge Sharing within LWB

The knowledge sharing within LWB has been carried out on the themes such as

- 1) Physical Losses and Capacity Assessment,
- 2) NRW Reduction Strategy,
- 3) Revision of NRW Reduction Strategy,
- 4) Commercial Losses and
- 5) Pipe Repairing in Physical Losses.”

Due to the withdrawal of JICA experts caused by the COVID-19 pandemic, the project activities were delayed for about a year. With the resumption of the activities physically after the return of experts, the results in each DMA under Output 2 will be actively shared at LWB internally.



Photo 4: Workshop of Pipe Repair

Workshops in Malawi

The first National Workshop on NRW Reduction was

held in June 2021 at LWB. The five regional water boards in Malawi, the Ministry of Forestry and Natural Resources, the Ministry of Youth and Sports, the Department of Forestry, and the Water User Associations actively participated in this Workshop.

The participants shared the information and experiences in NRW reduction at their organizations from different viewpoints and agreed to further promote cooperation. It was approved that the second National Workshop would be organized at Northern Regional Water Board since the Workshop is hosted on a rotation basis among the regional water boards.

Water Utility Regional Partnership (WURP)

Water and Sanitation Corporation (WASAC) of Rwanda, Embu Water and Sanitation Company (EWASCO) of Kenya, and LWB have organized a partnership to learn from one another, share information, and exchange views. The third workshop to be hosted by EWASCO had been postponed due to the COVID-19 pandemic. The WURP provides opportunities to share actual practices in the host country and enhance the host country's ownership of planning and organizing such a big event.

Public Relations Activities Involving Residents (Resident's Meeting)

A meeting with residents was held in the first DMA. The LWB invited influential residents to the meeting and exchanged views on NRW after giving them a presentation on topic. In the meeting, LWB distributed the awareness raising leaflet to the participants. The residents actively raised the requests and positive opinions to LWB, and LWB responded to each of them deliberately. This was a very effective tool for two-way communication between LWB and the residents.



Photo 5: Resident's Meeting at the First DMA

Public Relations Activities Involving Residents (Water Facility Tour)

LWB invited local primary school students to a water facility tour and later organized a workshop on NRW reduction to engage the students. The students were asked to discuss and give presentations in this workshop on two themes, "what impressed me the most in the tour" and "what we can do to reduce NRW" .

Presentations from the students suggested that the tour had enhanced their understanding of NRW reduction. Also, this tour enabled LWB staff to accumulate dissemination experience and enhance their skills in awareness-raising activities.



Photo 6: Water Facility Tour for Primary School Students

(4) Capacity Assessment (CA)

LWB and JICA experts conducted a baseline survey for the CA in August and September 2019 and analyzed the results. The analysis revealed that the capacities of LWB in the overall management of NRW and leak detection skills were excellent, while there was room to improve individual skills of C/P (Fig. 8).

The results were utilized for planning a training program in Japan to promote C/P's understanding and skill through live training in Japan. The idea contributed to facilitating the motivation of the C/P's to actively participate in the activities. The results were also utilized for recommendations to the LWB's internal training planning.

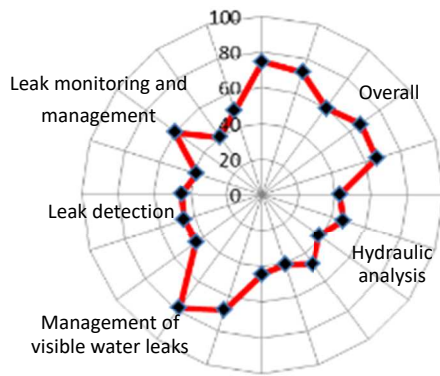


Fig. 8: Results of Capacity Assessment on Leak Detection and Control

(5) Additional Activities

Re-chlorination Management

The residual chlorine concentration survey was carried out at each pressure zone of the entire service area to examine whether the supplied water had proper residual chlorine. Based on the survey result, JICA experts proposed the installation of re-chlorination facilities under the pressure zones.

KIOSK Repairing

The drinking water was not sufficiently supplied in low-income areas of the LWB's supply area because of the frequent damage of KIOSKs. Quick repairs and rehabilitation of KIOSKs were necessary to help prevent the spread of COVID-19 among people near the KIOSKs.

Based on the findings in the field survey conducted remotely, the materials necessary for constructing KIOSKs, including non-contact prepaid water meters, and for constructing elevated water tanks will be procured.

Development of BCP

The JICA experts assisted in developing a business

continuation plan (BCP) required for continuing the LWB's business even during the COVID-19 pandemic.

As the CEO of LWB mentioned in the workshop on BCP, that it is crucial "to find ways to utilize the finalized BCP in the future," it is therefore expected that LWB will keep updating the BCP through with any unfolding events.



Photo 7: Workshop of BCP

Chapter 4. Effective Approaches and Lessons Learned in Implementation of the Project

(1) Involvement of C/Ps and Utilization of Workshop

While the LWB's staff members are occupied performing their regular duties, a unique working style is found in LWB. On particular occasions when some issues need to be discussed intensively, the LWB staff members are accustomed to being packed in a conference room outside the office for several days and concentrate on the given particular task. This style works well when they need to carry out any transient work, such as preparing a plan once a year or every three years, and has become a part of the corporate culture of LWB. It enhances the concentration of the participants and, indeed, brought fruitful results to activities under Output 1. This worked well for the development of BCP.

The style, applying for the short-term intensive work (workshop) and separating the staff from regular duties (off-JT), has been proven effective in the technology transfer and capacity development in the formulation of the plan.

While OJT is recognized as a basic method for technology transfer in technical cooperation projects,

the experts feel that such workshops can be effective when the contents of technical assistance match the corporate culture.

(2) Use of Online Conferences and Limitations of Remote Assistance

After the temporary withdraw due to the COVID-19 pandemic, the experts have frequently used online conference systems (such as Zoom) to maintain communications with the C/Ps.

An example of the technology transfer on commercial losses can be given were the expert organized an online lecture once a week on specific topics. Since an online lecture has a shortcoming that the participants' concentration does not last long, a session was limited to one hour and divided into several sessions. Initially, it was expected that one-on-one lectures would be organized; however, it turned out that two to seven C/Ps took the lectures and the technology transfer was carried out more than we expected.

From the experience, the experts strongly felt the limitations of communication through online meetings. The limitations included physical constraints, such as the unstable communication environment in Malawi, and the time difference between Malawi and Japan, which limits to set the time for the meetings. In addition, there are other limitations, such as difficulties in grasping the attitude and level of understanding of the C/Ps, their reactions in meetings, and their daily workloads. Besides the above-mentioned problems, the experts have agreed that organizers have to spend more time preparing for online meetings than face-to-face meetings.

With a full understanding of the above-mentioned shortcomings, careful attention should be paid to establish mutual trust and ensure that both the experts and C/Ps understand issues to the same degree that's when remote assistance through online meetings or lectures could be fully enjoyed. It is expected that the experts will continue utilizing the remote tools effectively, taking advantage and keeping in mind their limitations.

(3) Encouragement of Counterpart Organization's Ownership and Commitment

LWB has actively adopted and implemented activities proposed by the experts when they recognized that those proposals were relevant and in-line with organizational goals and that they contributed to capacity development in NRW reduction. Moreover, LWB has the motivation to continue implementing activities which were pursued together with the JICA experts without the assistance of the experts.

As for the attitude toward a highly motivated C/P organization like LWB, JICA experts need to closely monitor what C/Ps are doing, respect efforts taken by C/Ps, and minimize the experts' support. Even when the activity is concluded with unsatisfactory impact level, it is important to review the results and processes taken and have a common understanding of how to improve them.

(4) The flexibility of adjusting plans or activities according to the situation

It was a common perception that there were few surface leaks in the service area of LWB because leak repair had been quickly conducted in their daily work. However, it turned out that most leakages in the first DMA were surface leakages, easily detected visually. Such leakages are caused partly because of the shallow pipe installation and soil's characteristics in the project site (leakage easily reaches the ground). This observation re-confirms the importance of regular patrol for the early detection of surface leakages.

It is important to introduce new technology based on the project plan. On the other hand, even if it is confirmed that strengthening and promoting the activities practiced by C/Ps would bring more effectiveness, the activities need to be flexibly adjusted without being bound by the initial plan.

- End -