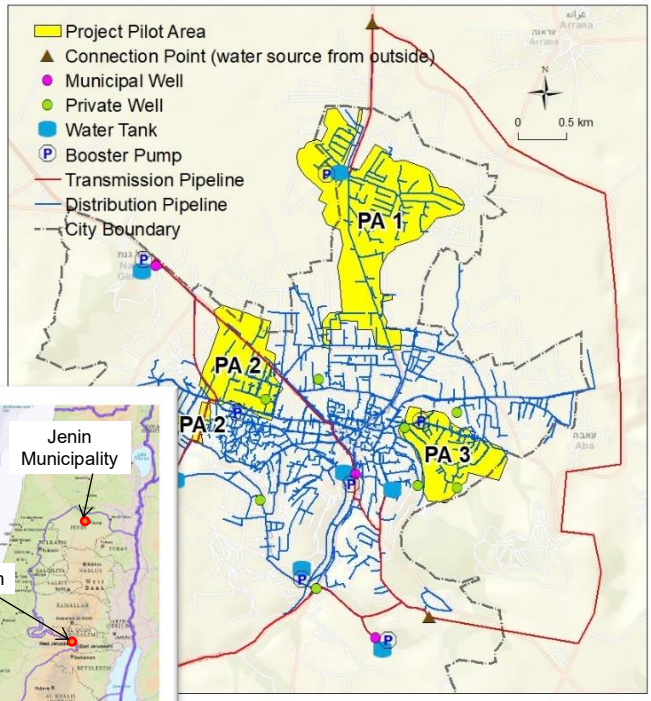
JICA PROJECT BRIEF NOTE

PROJECT FOR STRENGTHENING THE CAPACITY OF WATER SERVICE MANAGEMENT IN JENIN MUNICIPALITY IN PALESTINE

- Capacity development through NRW management, pre-paid water meter and digital technology -

October 2022



1. Background of the Project and Issues

In Palestine, rainfall is low (400mm~700mm) and concentrated in three to four months of winter, and surface water is virtually non-existing. Thus, the water resources are limited, mainly to the groundwater. Its population is growing and the gap between water availability and demand is increasing.

Major cities in Palestine have high Non-revenue Water (NRW) ratio (25%~50%), which is the percentage of water that cannot be billed due to leakage, theft, faulty meters, etc. Many water service providers are suffering from insufficient technical capacity such as leakage detection and water pressure control, as well as institutional weakness to discover and control illegal connections and to improve low water bill collection ratios (about 50%). Measures are required to effectively utilize the limited water resources. Therefore, reduction of NRW is an important measure in Palestine.

JICA conducted a planning survey in 2015-16 and found that Jenin Municipality had the highest NRW ratio (about 50%) and low bill collection ratio (about 60%) compared with other water service providers, and as a result, the Municipality was operating at a significant loss. Consequently, JICA approved to implement the Project for Strengthening the Capacity of Water Service Management in Jenin Municipality.

The Project started on 25th September 2017 and completed on 24th October 2022 with Jenin Municipality including its Water and Wastewater Department (WWD) as the main counterparts (C/P).

2. Approach

(1) Pilot project for NRW management

Three areas were selected as pilot areas (PA) for planning and implementing NRW reduction measures and a DMA (district metered area) was constructed in each PA to measure the inflow of water into this area. After measuring baseline NRW levels in the PAs, reduction targets were set.

The C/P were provided basic theoretical training in the beginning, and NRW countermeasures were implemented as on-the-job trainings (OJT). The Experts, primarily, implemented NRW measures in the first PA, followed by the second and third PAs mainly by the C/P. With the progression of work, the C/P gained more responsibility for the activities while the experts provided guidance and support. At the latter stage, the C/P were encouraged to find solutions best suited for the local condition by themselves to solve the NRW problems.

(2) Introduction of pre-paid water meter

Replacement of water meters with pre-paid water meters (PPWM) was planned to improve the bill collection ratio and reduce NRW. The introduction of PPWM was

expected to eliminate meter reading and collection work, increase the collection rate to 100%, enable automatic collection of unpaid bills (debt), and accurately acquire the amount of water used by customer.

The amount of debt, which increases every year, had reached approximately NIS 50 million (approximately 2 billion yen), which is equivalent to about 10 times the annual water tariff revenue of approximately NIS 5 million (approximately 200 million yen), putting a significant pressure on the municipality's finances. Therefore, in addition to the improvement of the bill collection rate, the collection of debt had also become an important measure for the municipality.

Before introduction of PPWM, intensive studies were conducted to prepare appropriate PPWM introduction strategies. The study included visits to other water providers in Palestine which had the experience of using PPWM. Lessons learned by them were collected. During installation of the PPWM, the customer service management system, including the system for PPWM, was established.

(3) PR activities and customer-oriented service

Public awareness activities for NRW reduction, as well as the activities for improvement of bill collection and debt recovery were routinely conducted with active cooperation between the Municipality's Public Relations Department (PRD) and the WWD. The active cooperation was particularly obtained in conducting PR activities for public awareness and participation, especially in convincing the customers for acceptance of PPWM and thus to avoid rejections of PPWM.

(4) Regular project meetings

Weekly or bi-weekly meetings were planned and held regularly during the Project. The meetings aimed to create the ownership of the C/P for the Project by providing discussion opportunities among the C/P to share challenges and solutions of their activities. During the COVID-19 pandemic, the bi-weekly meetings were held online, and the progress of activities and follow-ups were reviewed. After relaxation of the travel restrictions, the bi-weekly meetings were continued in hybrid mode, i.e., in person for the experts at the site and online for those who were not in Palestine.

(5) Digital transformation approach

Digitalization was introduced into many business processes to improve the quality of service, increase management efficiency, and provide useful information for decision-making quickly. Examples of digitization include:

- Remote monitoring and control of PPWM
- Introduction of mobile billing system
- Creation of customer database using GIS
- Online processing of customer complaints
- Online water connection application
- Web base monitoring of bulk meter reading

(6) Trainings in Japan

Training in Japan was conducted mainly in Iwate-Chubu Water Supply Utilities and Yahaba-cho in Iwate Prefecture for 10 officers, 2 from Palestinian Water Authority (PWA) and 8 from Jenin Municipality. The purpose of this training was to provide an opportunity to conduct research to identify ideas and solutions and to develop action plans to solve problems. Main theme of this training was water utility management style, finance and water tariff, utility organization, NRW management, awareness raising (public relations/ consensus building), and amalgamation of small-scale water utilities. The reason for including the amalgamation of small-scale water utilities in the training program was that the creation of regional water utility is underway in Palestine, and this was an issue for consideration in Jenin Municipality. The Iwate Chubu Waterworks is known as a waterworks utility that is making advanced efforts in the amalgamation and streamlining of waterworks services, and Yahaba Town is known as a waterworks utility that is making advanced efforts in terms of community participation and public relations.

(7) Implementation of activities by national assistants during the COVID-19 Pandemic

During the period before the COVID-19 pandemic, the Expert had transferred skills related to project activities to the national assistants as well as to the C/P. Project activities and capacity development activities were carried out autonomously and continuously by those national assistants even in the absence of the Expert during the COVID-19 pandemic.

3. Project Objectives and Outputs

Overall Goal:

Jenin Municipality's water service is improved.

Project Purpose: Jenin Municipality's water service management capacity is strengthened. Its indicators included:

- Reduction of NRW ratio of Jenin Municipality by 3% points compared with the Baseline
- Extension of water supply hours in the Pilot Areas
- Increase in collection ratio of Jenin Municipality by 9% points compared with the Baseline.

Five Outputs:

Output 1. Structure of NRW reduction activities and strengthening bill collection of Jenin Municipality is established
Output 2. Capacity to formulate plan for water service management of Jenin Municipality is strengthened
Output 3. NRW reduction capacity of Jenin Municipality is strengthened
Output 4. Direction for improvement of bill collection of Jenin Municipality is presented
Output 5. Project outputs and knowledge are shared among other water service providers

4. Activities and Results

Output 1: Structure of NRW reduction activities and strengthening bill collection of Jenin Municipality is established.

Assessment of existing situation indicated several crucial issues which required attention. The major issues in the water supply included short supply duration (1 or 2 days in a week), irregular supply schedule, lack of accurate monitoring of water production, daily operation of many valves for rationing water distribution, and lack of flow and pressure monitoring.

The city also suffered from leakage, which was caused by use of leakage-prone metallic pipe materials, long response time to repair leaks, lack of proactive leakage control, and inappropriate leak repair methods. Several other issues were also identified in relation to the installed water meters, illegal connections, reporting system, and data management.

Accurate water quantity measurement and NRW ratio calculation. Jenin Municipality compiled and provided its NRW ratio to regulatory agencies prior to the Project, but the authenticity of the data was questionable and procedure for data collection and NRW calculation were not established. In the Project, a systematic approach was established for NRW calculation including correct measurement of water production and consumption. To increase the accuracy of the supplied water quantity, bulk meters were checked systematically and those which showed unacceptable errors were replaced (Table 1).

Table 1 Flow volume check of bulk flow meter

No.	Quantity recorded (m^3)		Error of Source Meter (%) compared to UFM	Response
	Source meter (Mechanical)	UFM for check		
1	817.00	795.44	2.7%	Error within acceptable range
2	856.00	593.00	44.4%	The meter has been replaced since the test
3	405.00	390.05	3.8%	Error within acceptable range
4	818.00	779.40	5.0%	Error within acceptable range
5	678.00	607.80	11.5%	
6	1011.00	725.00	39.4%	The meter has been replaced since the test
7	592.00	640.52	-7.6%	
8	213.00	673.00	-68.4%	The meter has been replaced since the test
9	277.00	226.89	22.1%	Repeat test required to confirm the result
10	4772.00	3981.44	19.9%	Repeat test required to confirm the result
11	373.00	263.82	41.4%	The meter has been replaced since the test
12	114.8	101.5	13.1%	

Note: UFM: Ultrasonic flow meter

Other activities such as activities to revise the organization structure of WWD and to examine the existing management information system (MIS) were also included. Identification of necessary data (Performance Indicators) for the Project activities, measurement of baseline data, and endline data were also implemented.

Output 2: Capacity to formulate plan for water service management of Jenin Municipality is strengthened.

The water service management task force was established. The task force provided various OJT on corporate and financial management for water operation and appropriate water tariff setting. The OJT were on solving specific management issues such as business process improvement and institutional setup on bill collection and financial management. The trainings focused on staffing, organogram, capex, regulations, customer service, PR, and MIS/ICT.

The task force developed a mid/long-term business plan. As a result of the above activities, the Water Service Management Plan 2018-2027 (WSMP) for Jenin Municipality was prepared and approved by the Municipality Council in April 2019. The Plan aimed at providing the management framework and the strategic activities to solve the current challenges and the necessary funding resources to be obtained. The WSMP also signified consensus of stakeholders of the Municipality (i.e., the Mayor, Municipal Council members, city residents, and the Municipality employees). The overall goal, direct means and outputs were set as follows.

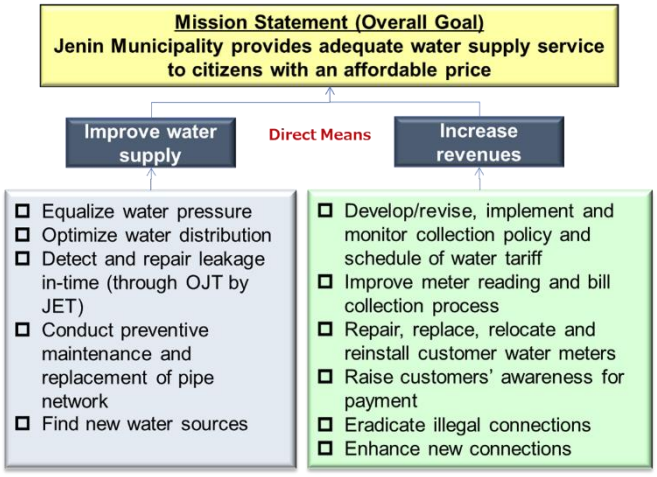


Figure 1 Goal, direct means, and outputs of WSMP

The annual business reports were prepared according to the WSMP. Throughout the project years, the annual reports of business plans were prepared and updated for years 2018, 2019, 2020, and 2021, with summaries for each year published on the Jenin Municipality's website and shared with the city residents via its Facebook page.

The District Service Improvement Plan (DSIP) was prepared. The DSIP aimed at accelerating the water supply improvement in whole Jenin Municipality, based on which, some of the valves were replaced or installed to improve water supply conditions.

Output 3: NRW reduction capacity of Jenin Municipality is strengthened.

NRW reduction team was established and NRW related trainings were conducted. Since many valves were needed to be operated on daily basis, significant portion of WWD's human resources was engaged in this task and it was given the first priority. The second priority was given to daily maintenance work including leak repair and new pipe installation. Although the leak repair was a part of NRW reduction, there was no particular section assigned especially for NRW reduction. Thus, a team consisting of core members of an Engineer and two technicians was set up and all available technicians were provided trainings on NRW.

Pilot Areas (PA) were selected. Three pilot areas (Figure 2) meeting many criteria as PA such as the number of customers, easy separation of the distribution pipe network from adjoining areas, were selected after evaluation of 8 potential areas. The PA2 included a portion of the refugee camp to grasp the status of water supply, meter reading, and NRW in the camp. Salient features of the selected pilot areas are shown in Table 2.

BOX 1: Pilot Area Selection Criteria

- Number of customers 300 to 1,000
- Well-developed drawings of the water distribution pipe network
- Easy separation of distribution pipe network
- Low night-time water consumption
- Ability to conduct leakage survey work at night (safety and technical aspects)
- Possibility of training on NRW reduction measures
- Potential for reducing NRW

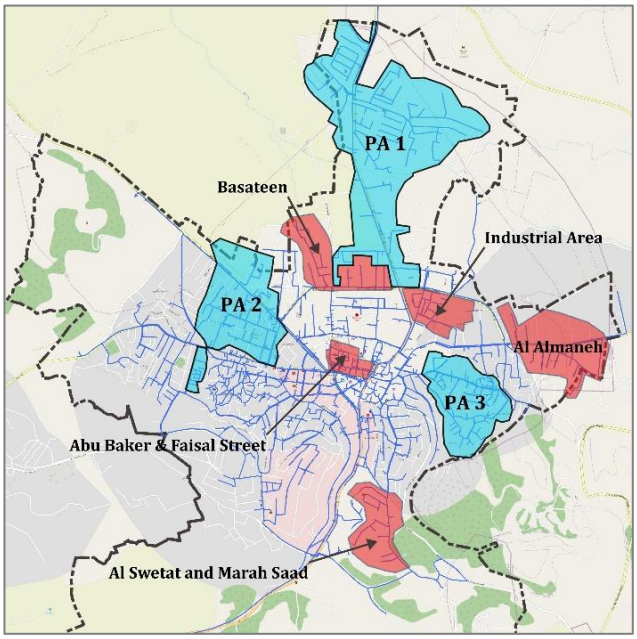


Figure 2 Candidate areas and selected Pilot Areas

Table 2 Salient features of the selected pilot areas

S. N.	Features	Unit	PA1	PA2	PA3	Total
1	Area	km^2	2.72	0.76	0.56	4.04
2	Number of connections	Nos.	863	671	575	2,109
3	Length of pipe (dia.≥25 mm)	km	17.89	14.09	11.32	43.30
4	Number of bulk meters	Nos.	6	5	2	13

Network drawings in Pilot Area were prepared and District Metered Area (DMA) was constructed. Procedure of DMA establishment is as shown in Figure 3. The implementation started from PA1 and later expanded to PA3 and then to PA2. Preparatory surveys including customer database and pipe network updates, and their mapping were followed by installation of bulk meters and isolation valves to establish the DMA.

PA1 and PA3 were easier to isolate but PA2 proved to be challenging. There were unknown pipe connections and buried valves in the boundary of this PA with adjoining areas.

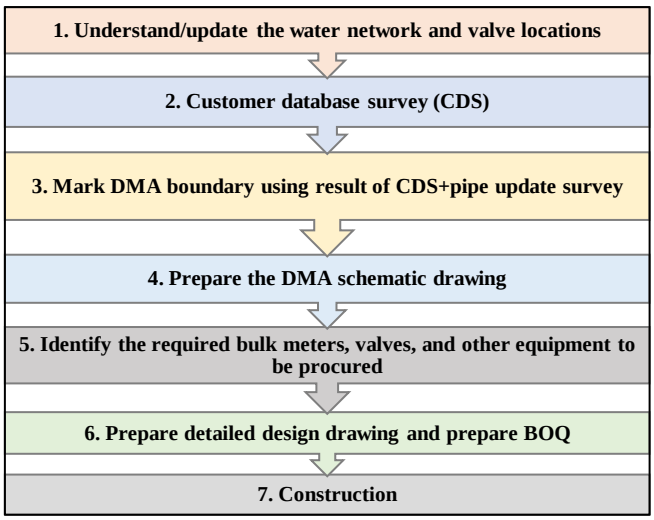


Figure 3 Procedure of DMA establishment

The status of NRW was grasped and countermeasures were implemented in Pilot Areas. In order to reduce the NRW, the following main countermeasures were implemented:

1) Surface leakage survey by patrolling, underground leakage survey by three methods; sounding survey, step test, and stop-cock method combined with sounding survey, and timely repair of found leaks,
2) Customer meter replacement by high accuracy ultrasonic meters (PPWM), and
3) Survey of illegal connections by investigating zero-consumption customers, and rectification of found illegal connections.

The stopcock method was developed as a simple and cost-effective method of NRW detection to suit local conditions while conducting leakage surveys in this project. A comparison of the step test and the stopcock method combined with acoustic surveys is shown in Table 3.

BOX 2: Stop-cock method

The stop-cock method is a simple method in which the inflow is monitored by an existing meter or portable flowmeter at the inlet of the area and all known customer connections in the area are closed. If then the inflow becomes zero, it indicates there is no leakage or illegal water use. If not, there is either a leakage or unknown/illegal water use. Then the network is surveyed for any leak or water flow sound in the pipe by acoustic method, using listening stick and/ or ground microphone. This helps further narrow down and finally pinpoint the leak or illegal water use area.

Table 3 Comparison of step test and stop-cock method

Items	Step Test	Stop Cock Method with Sounding Survey
Method outline	The survey area is divided into several sections by valves. Inflow to the area is monitored/ measured while the sections are closed and opened successively by the valves. **The preparation is complicated.**	Stop cocks of all known connections in the survey area are closed, inflow to the area is monitored (if possible), sounding survey is conducted if there is any inflow or sound.
Access requirement to house connection	**It is not necessary to close each connection.**	**Access should be available to each connection to close them.**
Certainty of result	Cannot differentiate whether the inflow is due to legitimate use or leakage or illegal use.	**Since all known connections are closed, if there is any inflow we can be certain that it is either due to leakage or illegal connection or missing customer.**
Precision of location	This test gives just **an indication** but precise result cannot be obtained. Further survey is required.	With this method it is possible **to identify precisely** the location of leak or illegal water use / missing customer.
Survey time	To get more meaningful result this test should be done **during minimum night flow (MNF) time,** but still legitimate use exists.	**Nighttime work is not required**, it can be done during daytime when there is water supply.
Supply condition	**Continuous (24/7) supply is required**.	**It is effective even in intermittent supply condition**.
Suitability in the condition of Jenin	Less effective, difficult to apply because of intermittent supply and security situation to work at night.	More suitable for the condition of Jenin.

As a result of NRW countermeasure, the NRW in PAs has decreased as shown in Figures 4, 5 and 6.

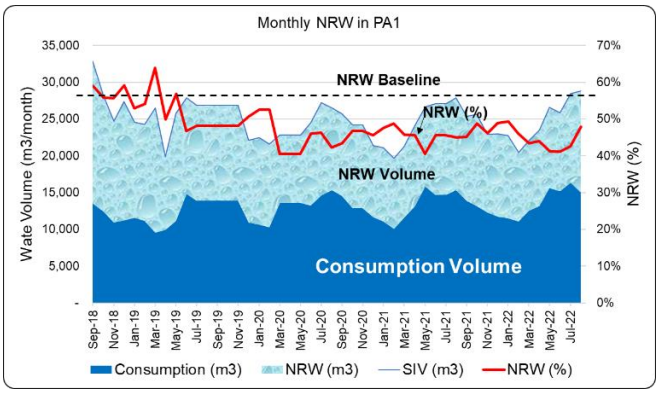


Figure 4 NRW trend in PA1

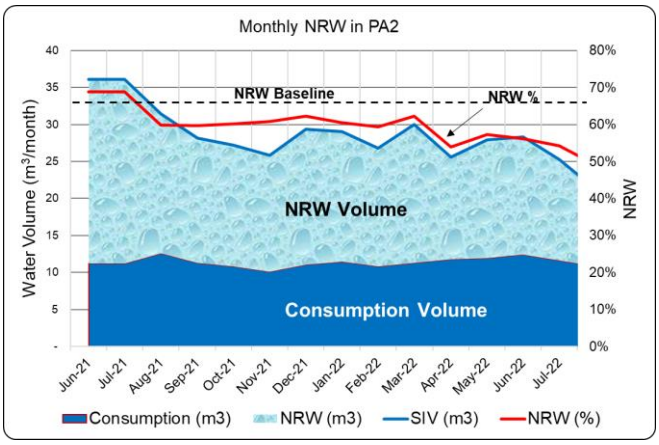


Figure 5 NRW trend in PA2

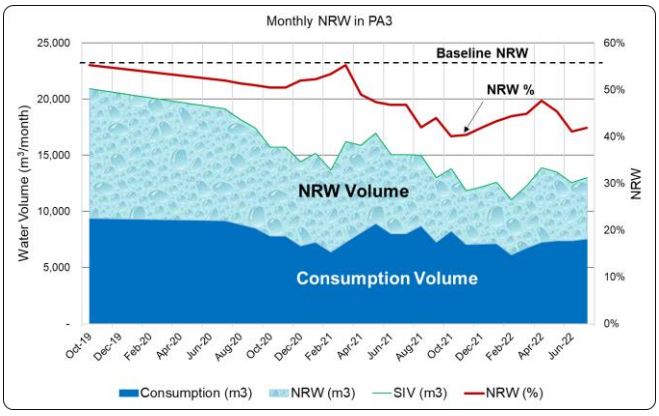


Figure 6 NRW trend in PA3

Cost-benefit analysis of NRW reduction measures indicated the cost-effectiveness of all implemented measures. The cost-benefit analysis result is shown in Table 4. Based on this analysis and other experience, an illustration of cost-effectiveness of various measures in case of Jenin is deduced as shown in Figure 7.

Table 4 Cost benefit analysis of NRW reduction measures

Countermeasure	Method	Value
Leak detection and repair	Benefit / Cost ratio	10.9
Customer meter replacement (with PPWM)	Benefit / Cost ratio	2.1
If the meters were replaced with mechanical meters	Benefit / Cost ratio	7.7
Illegal connections rectification	Benefit / Cost ratio	7.1
Overall	Benefit / Cost ratio	**3.5**
Source meter checking and replacement	Payback recovery period	0.27 years (3.2 months)

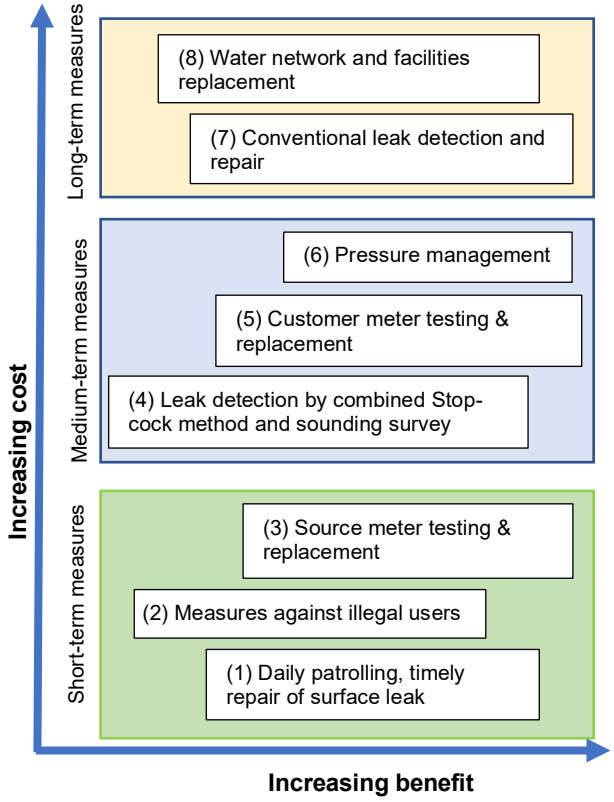


Figure 7 Illustration of cost-effectiveness of various NRW reduction measures in Jenin

DMA plan & NRW reduction rollout plan (ROP) of entire city were developed, incorporating lessons learned from the implementation of activities in the PAs and their cost-effectiveness. The main features of the plan were:

- Entire city is divided into 18 DMAs. These include three project PAs which were already implemented.
- The DMAs were assigned priority levels of implementation based on degree of progress of preparatory works, ease of isolation, and availability of suitable bulk meters in stock. Jenin Camp and Industrial Area were assigned zero priorities because they could be taken up quickly, possibly within the end of year 2022.
- The detailed implementation plan covers the period until year 2024 within which 9 additional DMAs are scheduled to be completed. By this a total of 13 DMAs will be completed.
- The remaining 5 DMAs are to be taken up after completion of the above.
- Outline of planned DMAs along with their implementation priority is shown in Figure 8.

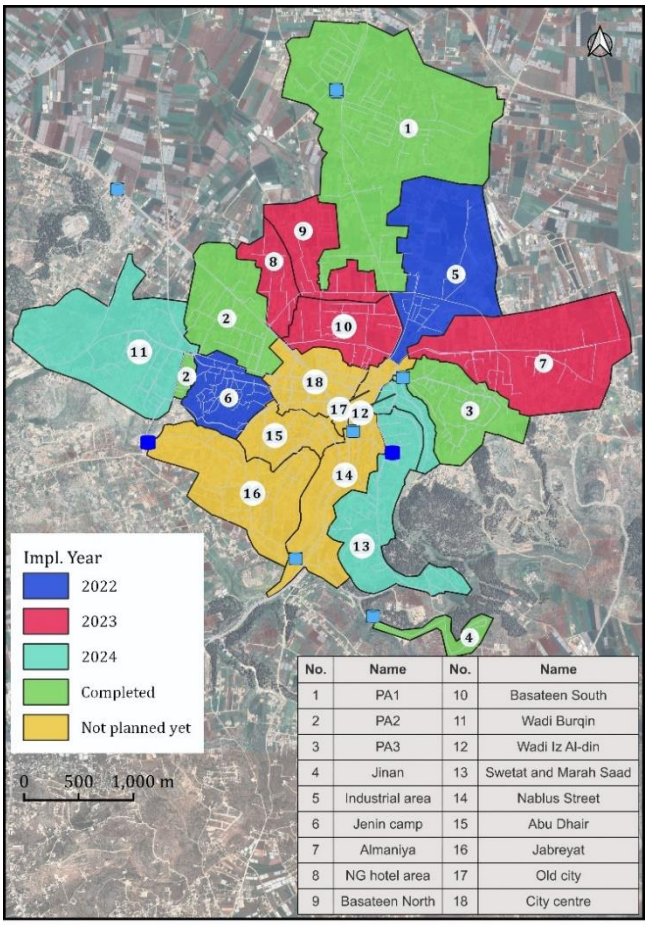


Figure 8 DMA plan and implementation year of ROP

Manuals on NRW reduction were developed. Two versions of NRW manual were prepared: 1) the basic version in English and Arabic and 2) the comprehensive version in English. The basic and the comprehensive versions are intended for use of technicians and engineers, respectively. The manuals provide step-by-step guidance for planning and implementing NRW reduction activities in the DMAs. Similarly, manuals for operating and maintaining various equipment used for pipe location, leak detection, and flow and pressure measurement were prepared in both English and Arabic languages.

Output 4: Direction for improvement of water bill collection of Jenin Municipality is presented. The steps for improving water bill collection in Jenin are shown below.

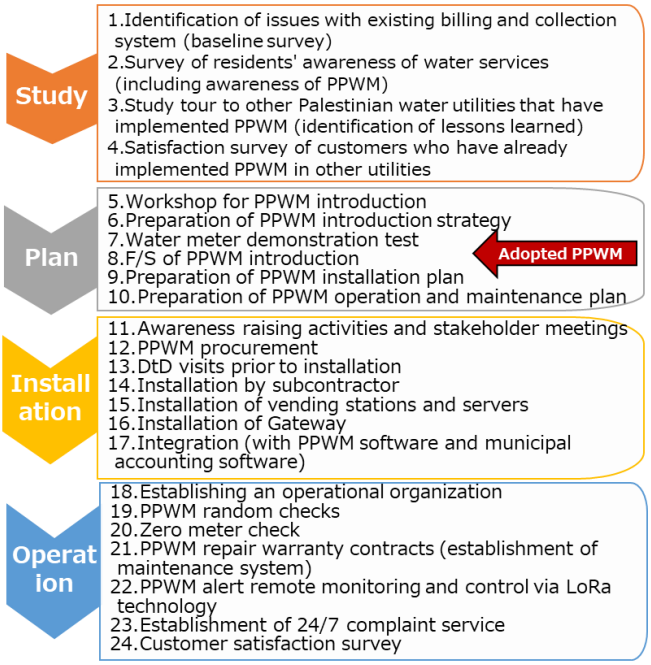


Figure 9 Steps of improvement of water bill collection

The interview-observation-based baseline survey revealed many issues. Focusing on WWD's Customer Service Section (CSS) and Collection Unit in the Municipality Office, the existing conditions and issues of water meters, and billing and collection system were analyzed. Various issues listed below were found and in addition the issues related to workflow, staffing, software, MIS, ICT, GIS, customer database, and public relation are identified. Further discussions were held on how to address these issues towards improvement of the WWD, especially the CSS.

- Zero-meter readings (zero consumption recorded in meter readings)
- Estimated consumption without reading
- Many inaccurate water meters
- Many broken and unreadable meters
- Meters inaccessible to meter reader and unreadable
- Meter readers given responsibility for meter reading and bill collection in a large area
- Some customers not receiving billing statements
- Customers with high consumption complained about their water bill

The results of customer opinion survey showed a challenging situation. The survey mainly focused on findings for: 1) willingness to pay for water tariff, 2) opinion on PPWM, and 3) Customer satisfaction of the municipality's water services. The survey was conducted at first at PA1 and then extended to the entire city.

The major findings showed a low overall customer satisfaction mainly due to inadequate water supply conditions and the poor services. A high percentage of the customers had access to the Municipality's water supply only one day a week, especially in the summer, showing 47.5% in PA1 and 61.4% in entire city. Also, 54% (PA1) to 60% (entire city) of the customers were not satisfied with the water services at the Municipality. 35% of the respondents in PA1 were not willing to pay a slightly higher tariff even if the water services would improve (Figure 10). The results showed that the Municipality faced a serious challenge towards satisfying its water service customers especially with the water supply hours and service management.

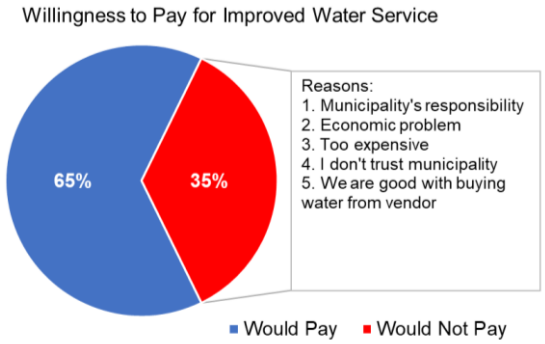


Figure 10 Result of willingness to pay in PA1

The case study aimed to understand the existing PPWM system in Palestine and provided recommendations for a successful PPWM strategy. The related studies included the following aspects:

a) To understand existing PPWM system in specific towns in Palestine and collect lessons learned
b) To obtain success factor of the towns
c) To understand opinion of users on PPWM in existing PPWM introduced towns
d) To understand opinions of the C/P on introduction of PPWM
e) To understand the results of opinion surveys on PPWM in PA1 and entire city

The PPWM study identified valuable lessons learned and provided recommendations for Jenin Municipality as follows:

(1) Type of meter; the study suggested ultrasonic meter for the reasons mentioned in Box 4 but recommended that an experiment in actual water supply condition in Jenin be conducted before introducing such water meter.

(2) Success factors; the study suggested the following factors to be met as much as possible:

- Free meter replacement for existing customers
- Improvement of water supply conditions
- Affordable and good quality water
- Good and responsive, 24-hour customer service
- Earn trust of customers by good communication

(3) Improvement of water supply conditions: One of the success factors, 24/7 water supply, was not possible to achieve without infrastructure improvement project. However, the water supply conditions might be improved with existing infrastructure if water distribution management was improved.

(4) Improvement of customer service: According to the social survey, the customers were not satisfied with water

supply service of Jenin Municipality. If the Municipality obtained the trust of customers, the acceptance of PPWM would become easier. To obtain the trust, the Municipality should improve its service of water supply at the time of introduction of PPWM, especially in the pilot area at first. For this purpose, capacity of customer service and operation and maintenance of water supply system should be strengthened.

(5) Development of public awareness strategy: According to the social survey, willingness to accept PPWM is 67 % and 61% in PA-1 and in city-wide, respectively. About 1/3rd of the surveyed customers were not willing to accept PPWM. Therefore, the strategy was necessary for a smooth installation and to avoid rejection of PPWM.

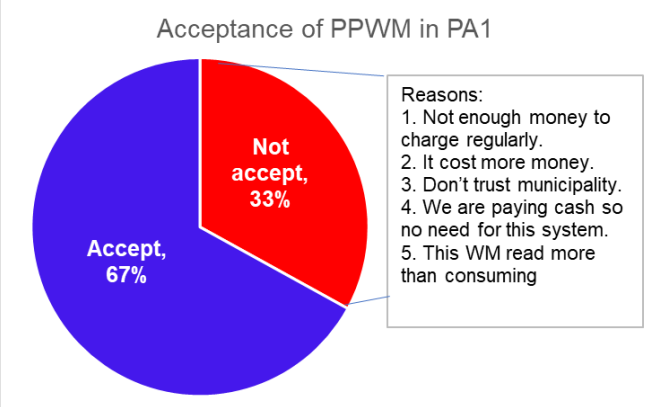


Figure 11 Acceptance of PPWM in PA1

Direction for improvement of water bill collection of Jenin Municipality was presented after the above surveys. The existing issues related to billing and collection in Jenin Municipality were reviewed. Low bill collection ratio in the Municipality was the result of problems in the existing meters, customers' dissatisfaction, inefficient work of meter readers, availability of private water venders as alternate sources, intermittent water supply, etc.

Under such circumstances, the introduction of PPWM was a potential solution for improving the bill collection. The project team identified expected improvement after introduction of PPWM and carried out a feasibility study for introduction of PPWM. Finally, the introduction of PPWM was decided with the following measures.

- Setting up "PPWM Implementation Team" and holding periodic meetings
- Preparing detailed implementation plan
- Making periodic monitoring and evaluation during implementation

BOX 3: Selection of meter type

In Jenin, intrusion of air into the piped supply is ubiquitous because of intermittent supply conditions. Water customers suspected that measurement of trapped air by the water meters caused erratic and high-water bills. To select a meter most suitable to local conditions and effective in terms of non-recording of trapped air, a detailed experiment was conducted by installing three types of (volumetric, velocity and ultrasonic) water meters in series. Among these, the ultrasonic meter was selected as it did not measure trapped air, the flow path was unobstructed, had no moving parts, which would increase lifetime of meters, and also the prices of 3 types PPWM were not much different.

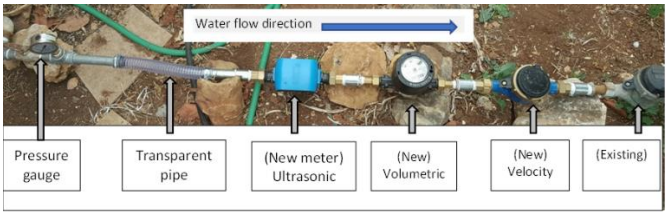
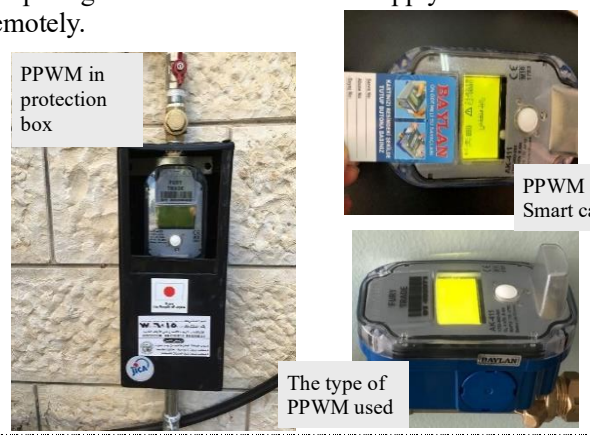


Figure 12 Arrangement of meters for experiment test

After a detailed implementation plan was prepared, JICA procured 1,850 PPWM, and installation to 3 PAs started.

BOX 4: Pre-paid water meter

The PPWM system is based on the principle that a credit charged in advance exhausts as water is consumed based on a pre-programmed water tariff. Every meter is operated by its own smart card and credits are loaded into these cards from vending stations. Prepaid meters can also be programmed for reserve water to be used during emergency or firefighting. PPWM systems can also detect tampering with the device and supply can be cut off remotely.



The PPWM procured is ultrasonic type smart meter with a function of LoRa technology. Twelve vending stations (VS) (Figure 13) were set up at convenient locations where customers could buy credits to recharge the meter. Through the Gateway and LoRa technology all PPWM could communicate remotely with PPWM server and PPWM customer database.

The data from PPWM is sent to the Gateway by LoRa (low-power radio waves for communication) and sent to PPWM server from the Gateway by GPRS. Three Gateways were installed for the PAs (Figure 13) at the highest place in each PA such as Mosque and higher building to receive PPWM data and transmit to PPWM server. This system enabled the CSS staff to remotely read meters, and check credit balance, battery and valve status,

tampering attempt and so on. It also enabled them to close and open the meters and even to charge credit remotely.

The PPWM customer database was integrated with the existing customer database system of the Municipality so that all customer data was integrated in the Municipality system. The established PPWM management system is shown in Figure 14. This system enables the staff to monitor not only customer's payment status but also their daily or even hourly water consumption remotely. The data of PPWM are received from meters twice a day, which is monitored by the staff of CSS. If any failure or warning is noticed in the received data, the staff visits the site quickly and takes appropriate action. This system is very helpful to increase efficiency of customer services including solving customer complaints.

At the beginning of PPWM introduction, three VSs were established at a supermarket and two Municipality's kiosks. Later, the Municipality contracted with Palpay company, and 10 supermarkets that transact with Palay started charging service considering customers' convenience.

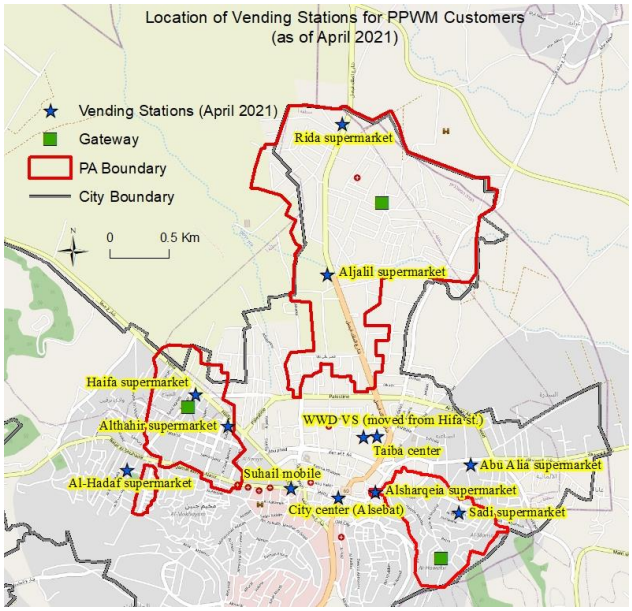


Figure 13 Location of gateways and vending stations

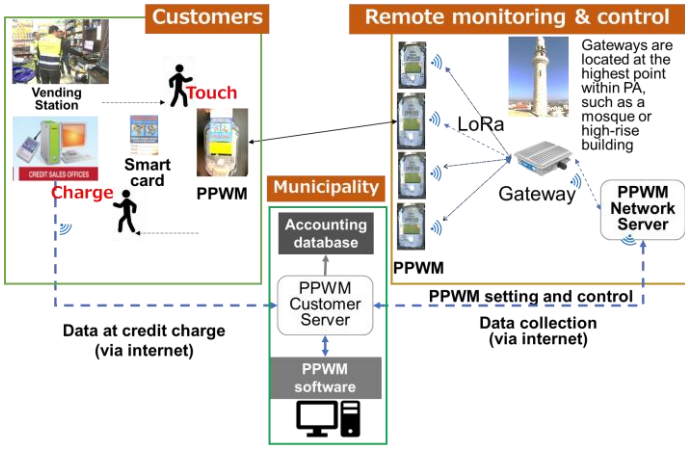


Figure 14 PPWM management system

With the PPWM, bill collection is always 100%, and meter reading, billing and collection work are no more required. In addition, the function to recover the debt from the customers is set in PPWM, and the debt is automatically collected at every charging of the PPWM card. Initially, the percentage of debt collection was set at 10%, but later increased to 15-20%, depending on the amount of debt.

With success of PPWM in PAs, the Municipality procured 1,700 PPWM (1,390 has been delivered) by own budget. The current status of PPWM installation is shown below.

Table 5 Total installation of PPWM as of June 2022

Area	Total Customers	Installed	% Installed
PA1	863	737	85%
PA2	671	538	80%
PA3	577	533	92%
Out of PAs	-	1,365	-
All City	9,690	3,173	32%

Other issues related to the bill collection were identified and the countermeasures were taken for improvement.
A 'Procedure Manual for Customer Service Management' was prepared as a reference for improved activities to address the issues and challenges found. The improvements were related to the existing workflows, new workflows, digitization of workflows, improved customer database and GIS system, meter replacement with PPWM, enhancement of public awareness activities, and capacity building of the staff by various trainings. Presented below are some of the improved and new activities conducted by the CSS.

(1) Revision of service subscription contract: The subscription contract was revised accordingly for PPWM contracts.

(2) Improvement of monitoring activities.: Monitoring and inspection of water meters with zero or minimum monthly consumptions, and examination of potential illegal connections.

Site visits of water meters with zero consumption

Discovered illegal connections in red circle - self connection

Photo 1 Site surveys for checking PPWM and illegal connection

(3) New workflows for PPWMs i.e.: Random site check of PPWMs for possible malfunctions, and remote monitoring of PPWM using the Gateway software in cooperation with other sections and departments.

(4) Efficient billing and collection system: Reading of all water meters throughout the city by introducing mobile billing system (MBS) instead of estimations for some meters.

Photo 2 Training and use of mobile billing system

(5) Improvement of MIS and digital business transformation. It included:

a) Upgrade of the customer database management system (Al-Shamel software) including the server improvement and backup system,
b) Online water service applications via Document Management and Archiving System (DMAS software),
c) Mobile water meter readings and billings (Mobile Billing System),
d) Use of PPWM and VSs (Baylan Software),
e) Online monitoring of PPWM (Baylan Metering System); Gateway LoRa system,
f) Automation of bill collection (Palpay system),
g) Establishment of GIS-based customer database,
h) Digital processing of customer complaints (JM's Website-based Customer Complaints system,
i) Use of SMS to remind customer for bill payment,
j) Use of Google Sheets for file sharing,
k) Digital archiving of paper customer service contracts and all their application documents (customer files)
l) Customer database system integration.

Use of GIS database for random check of PPWMs by locating the customer water meters on map

Photo 3 Use of GIS for customer services

(6) Improvement of means of transportation for CSS's activities by providing car and electrical motor bicycles. Previously, there was no transportation means dedicated to CSS. The procured van by JICA has a great impact on conducting CSS's daily activities which had to be delayed in the past due to lack or shortage of means of transportation.

Photo 4 Transportation means dedicated to CSS

(7) Many OJTs in Jenin, Palestine, and Japan, and hands on experience with maintenance of the PPWMs were implemented and the capacity of the CSS improved greatly.

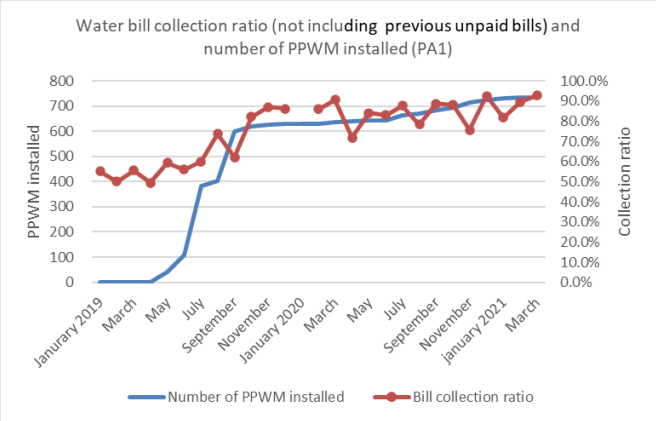
a) This improvement includes the performance of customer service, increased monitoring of installed PPWM and mechanical meters for any malfunctions or misuse, improved automation of inventory system in warehouse instead of paper-based inventories and enhanced capacity in terms of preparation of plans, planning, report generation, and data analysis.
b) The CSS is now accustomed to taking preventative measures to reduce customer complaints.

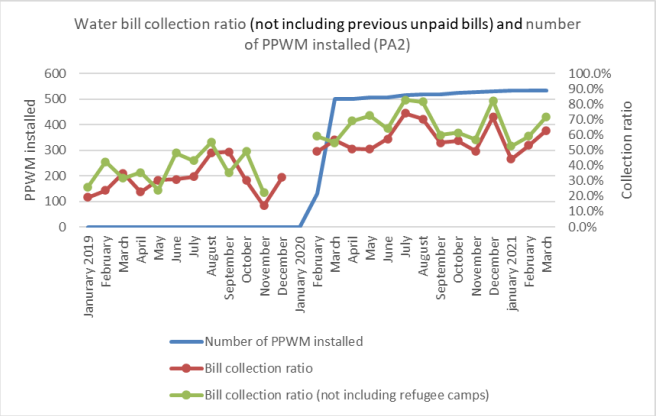
The CSS calculated the bill collection ratios on monthly basis and monitored the ratios. Monthly collection ratios were measured for PAs and entire city and is ongoing on monthly basis. The available methods for water charge collection increased. It became three ways to collect water charge as shown below.

Table 6 Available methods of water charge payment

Means of Collection	Method
1) By Mobile Billing System (MBS)	When Readers/collectors read the mechanical water meters, they also print the bill using the MBS and deliver the bills. Many customers choose to pay to the collectors at the time of reading.
2) By Palpay system	Customers pay their bills at Palpay vending stations in many supermarkets which automatically transfers the collected bill to the Municipality's bank account.
3) By PPWM	Customers purchase credits at vending stations and thus pay their bills in advance.

Installation of PPWMs had a significant impact on increase of collection ratio especially in the PAs as shown in Figure 15 and Table 7.





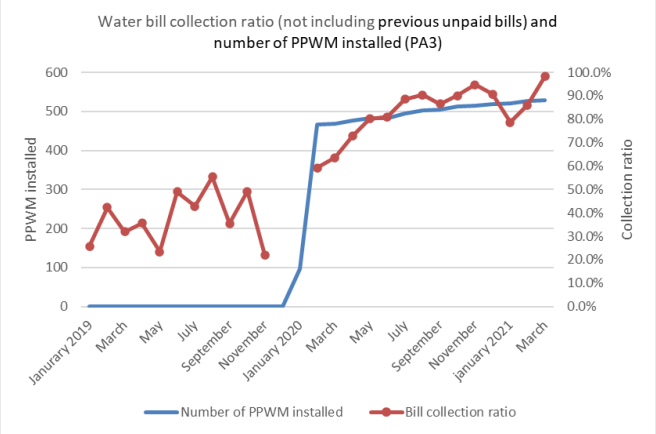


Figure 15 No. of installed PPWM vs collection ratio in PAs

Table 7 Collection ratio before and after PPWM installation

Area	Before installation (without debt)	After installation (without Debt)
PA1	About 50%	80-95%
PA2 (without camp)	20-50%	60-75%
PA3	20-50%	80-100%
All city	35~45%	54% (Oct 2021)

As a measure for the socially vulnerable group of people against PPWM, upon application from the concerned customer, eligibility is evaluated and the PPWM valve is opened and the PPWM is used as a post-pay meter thereafter. This allows the amount of water used to be recorded as debt, which is a mitigation measure for the introduction of PPWM for this group. Revision of water tariffs for this group is underway. Assuming that this group uses less water, the tariff will be lower for customers who use less water. The current normal water tariff rate is 4.34 NIS/m^3 (about 170 yen), which is about 65 NIS/month (about 2,600 yen) for a household using 15 m^3 of water per month.

In addition to the installation of PPWMs, measures such as debt collection campaigns, customer database cleanup, mobile meter reading and billing system, zero-meter readings and replacements of non-functional meters, sending SMS bill payment reminders to customers, and organization modifications have played significant roles in improvement of bill collections.

CSS also established an online customer complaint system via Jenin Municipality's new website. A 24/7 phone call service and WhatsApp for complaints are also available now. CSS keeps constant recording of all complaints and solves issues in shortest time possible in cooperation with other sections. Online messaging of complaints is also available via the Jenin Municipality's FB page. Details of customer complaints in June 2020 is shown in Figure 16.

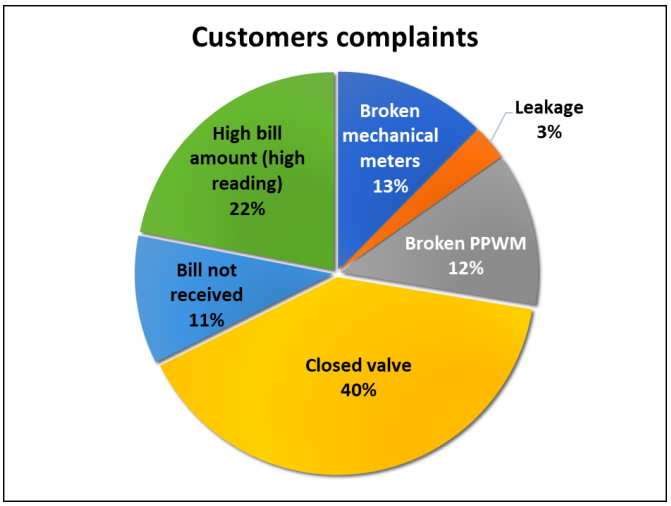


Figure 16 Customer complaints in June 2020

The PPWM procurement contract included a warranty period of three years, allowing sufficient time for the establishment of an operation and maintenance system, including failure response. The failure rate is about 7%, with the valve not operating in 40% of cases, the largest, followed by internal meter leakage in 30% of cases. After the warranty period, maintenance is outsourced. In the event of a failure, the meter is quickly removed, replaced, and sent to an outsourced maintenance center for repair. Almost all PPWMs are repaired and returned.

One of the great achievements of the project was a high customer satisfaction with PPWM. A post-installation survey of about 10% of the PPWM customers in PAs showed that 98% of total surveyed 195 customers were satisfied with their PPWM experience. The 2% of unsatisfied customers indicated dissatisfaction with the water supply situation, but not the water meter.

CSS, in cooperation with PR Department, launched extensive PR activities for the Project. The PR activities played an important role in the resident's awareness and acceptance of PPWM resulting in only a low percentage of rejections. The public relations activities that were implemented during the project period, and still ongoing, included:

- Customer database survey (CDS)
- Neighborhood meetings and meetings with community leaders
- Preparation of PPWM PR materials
- Door to door visits prior to installation of PPWM for awareness purpose
- Re-visit of customers who initially rejected PPWM installation
- Post-installation visits (Customer satisfaction survey visits)
- Using social media channels
- Preparation of PR materials i.e., movies, posters, calendars, and animation
- Social case (socially vulnerable family) study in cooperation with WWD
- Cooperation with other institutions for raising public awareness in the city
- Bill collection campaigns (soft-approach)
- School visit awareness activity

School visit awareness activity

Debt collection campaign

Awareness poster

The analysis and monitoring results were helpful for proposing the future direction for customer meter replacement. With the success of the pilot project, the Municipality has decided to install PPWMs at all customers. In addition to the 1,850 PPWMs which were procured by JICA and installed in PAs, the Municipality also installed about 1,400 PPWMs outside the PAs. JICA provided additional 4,350 PPWMs to cover the whole city as a COVID-19 pandemic relief measure.

PPWM replacement plan for entire city was prepared based on the results of Pilot Areas. Since the PPWM system, like the server, software and integration were already in place, Jenin Municipality would require increasing the number of the system's vending stations and gateway devices only as the number of the installed PPWMs increases. Continuous and a close cooperation of various departments as shown below is envisaged.

Table 8 Inter-departmental cooperation in PPWM installation

Departments	Major involvement
WWD (CSS, Water Section, Studies and Planning Section, Warehouse)	Main implementor of PPWM installation and monitoring activities.
Public Relation Department	Public awareness and door to door visits
IT Department	Technical issues with PPWM software and servers, VS
Financial Department	Customer payments database, financial reports
Public Citizen Center	Service applications on DMAS system
Legal Unit	Process for illegal users, enforce penalties
Human Resources Department	Hiring of new staff if needed
City Council /Mayor's office	Provide support for the team when needed

The main strategy for the PPWM installation works is that the city will be divided into 4 areas in which the installation is implemented in 4 stages. A team to supervise installation of the PPWMs by the contractor, which consists of 3 members with engineer, water technician, and technician assistant, will be formulated. There are also CDS (for customer database survey) team, PR team, GIS team, and PPWM operation & monitoring team. All teams will be supervised by the head of WWD.

As the number of PPWM increases, expected revenue increases as well. The plan provides an estimated forecast revenue from PPWMs (Figure 17).

It should be noted that the PPWM delivery was delayed much since Israeli custom clearance was delayed by almost one year. Finally, they were delivered in September 2022.

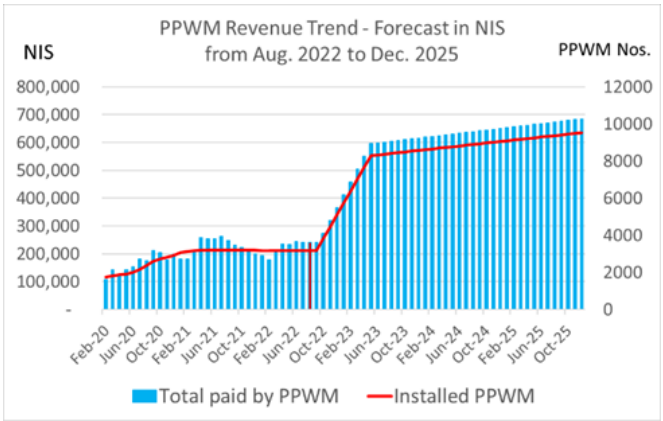


Figure 17 PPWM monthly installation and revenue projections from August 2022 to December 2025

Output 5: Jenin Municipality's project outputs and knowledge are shared among other water service providers

Three technical seminars were held to share the experience gained from the project with other service providers. The first, second, and the last seminar were held on 10th April 2019, 27th October 2020, and 22nd May 2022, respectively. The second seminar was held with online system due to the COVID-19 pandemic. About 140 persons from PWA, Ministry of Local Government (MoLG), development partners, Jenin Municipality office, about 30 water providers/other municipalities including Gaza district participated in the seminars. The manuals and materials prepared in the Project were shared in the 3rd seminar in digital soft copy in a USB drive.

5. Project Outcomes

Training Participants

Ten persons, eight from Jenin Municipality and two from PWA, received training in Japan. The training was more practical and provided them an opportunity to find ideas and solutions for the problems that Jenin Municipality and PWA were facing in the water utility management.

In-house trainings were designed and provided to train the C/P in related fields including NRW, basic hydraulic, GIS, hydraulic modeling, customer management and so on. Summary of the number of trainings and meetings, and number of persons who received the trainings is shown in the following table.

Table 9 Number of training events and participants

Events	Number of events	Number of participants
Technical training	90	640
Seminar	4	170
(Bi)weekly meeting	134	529
Monthly meeting	8	103
Total	236	1,442

As of end of September 2022

Development of Capacity

A capacity assessment was conducted to measure the degree of capacity development before and after the project. The elements of capacity are organizational and individual capacity, core and technical capacity. Technical capacity refers to specific technical capabilities such as technology, knowledge, and skills. Core capacity is the fundamental ability to handle and solve various problems using technical capacity, i.e., management capacity, including leadership, problem-solving skills, operational performance, human resource development, and the overall environment and culture that motivates staff. Core capacity must be emphasized in conjunction with technical capacity because technical capacity alone, without appropriate core capacity, cannot solve problems.

As a result of the Project activities as shown in figures below, i) Overall core capacity of the organization, especially of adaptation, has been developed, ii) Technician's capacity has been developed year by year, and iii) Capacity of CSS and PRD has also been developed.

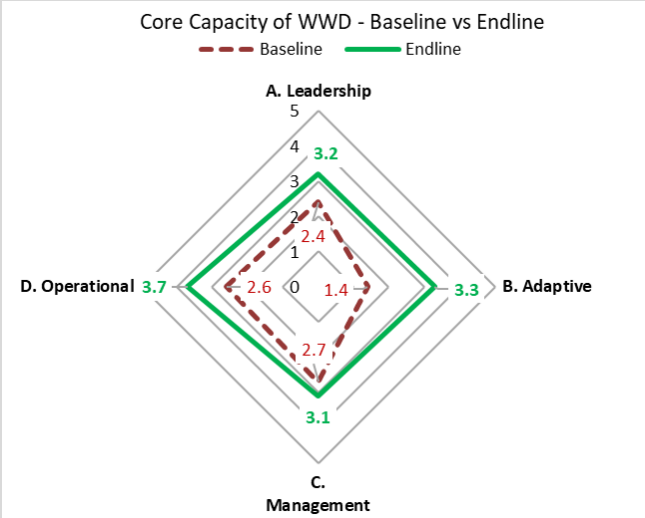


Figure 18 Progress of WWD's organizational core capacity development

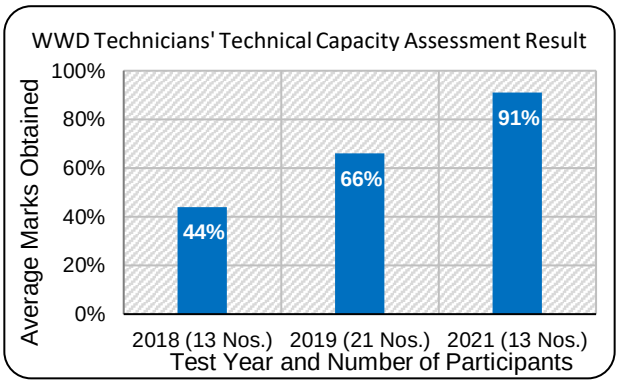
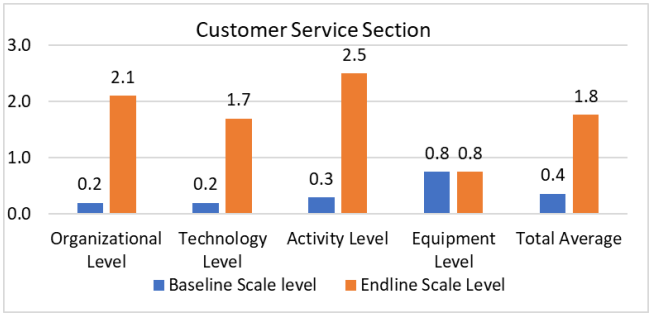


Figure 19 Overall result of technical capacity assessment in three tests



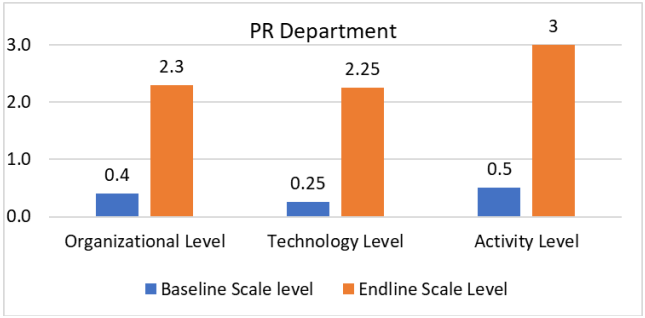


Figure 20 Capacity development for CSS and PRD on a basis scale of 0 to 3 (before and after project)

Improvement of NRW and Bill Collection

NRW and bill collection ratio in PAs as well as in whole Jenin decreased and increased, respectively as shown in the following tables.

Table 10 NRW ratio decrease in PAs and entire Jenin

Area	NRW baseline (%)	Lowest NRW achieved (%)	Decrease from baseline	Latest NRW (%) Jun 2022	Decrease from baseline in Jun 2022	Target reduction (%)
PA 1	57	40.6 (Mar~May 2020)	-16.4	41.1	-15.9	
PA 2	66.1	53.9 (Apr 2022)	-12.2	56.2	-9.9	
PA 3	55.2	40.1 (Oct 2021)	-15.1	41.0	-14.2	
Av. of 3 PAs	59.4	44.9	-14.6	46.1	-13.3	-12
Entire city	60	54.0 (Jun 2022)	-6.0	54.0	-6.0	-3

Table 11 Collection ratio increase of PAs and entire Jenin

Area	Baseline (%)	Highest collection ratio achieved (%)	Increase point (%)	Jul 2022 (%)	Average increase in Jul 2022 (%)	Target
PA1	60.8	99.6 Jul-21	38.8	91.5	30.7	Average 35% increase in total
PA2	36.8	67.7 Sep-21	30.9	65.2	28.4	
PA2 without Camp and Institution		99.7 May-22		89.1		
PA3	48	98.3 May-22	50.3	87.6	39.6	
PA average	48.5	88.5	40.0	81.4	32.9	
Entire city	41.2	53.80 (Oct. 21)	12.6	49	7.8	50.2% (9% points)

The introduction of PPWM improved the bill collection ratio from approximately NIS 250,000/month (about JPY 10 million/month) to NIS 360,000 (about JPY 14.4 million/month) per month in the citywide, indicating 1.44 times more than before the introduction of PPWM.

The annual collected amount without debt in PAs and the entire city since 2018 is shown in the table below. The collection amount in 2021 increased by 1.5 to 2.4 times in PAs and 1.5 times in the entire city comparing with those in 2018.

Table 12 Collected amount without debt since 2018 (NIS)

PA	2018	2019	2020	2021	Increase rate from 2018
PA1	487,435	558,367	644,980	726,995	1.5
PA2	195,714	192,451	411,509	470,039	2.4
PA3	231,627	174,627	432,345	444,540	1.9
Total of three PAs	914,776	925,445	1,488,834	1,641,573	1.8
Entire city	2,867,383	2,549,418	3,222,552	4,211,877	1.5

Note: The installation of PPWM started in April 2019 and mostly completed in February 2020.

Enhancement of equitable water use by PPWM

A comparison of customer water consumption before and after installation of the PPWM is shown in Figure 21, which indicates that before installation of PPWM while many customers used large amounts of water, many customers used little or no water at all, probably due to lack of adequate pressure. On the other hand, after installation of PPWM, the customers who used a lot of water before reduced their water consumption, while those who used minimal or no water before increased their consumption. The PPWM has played a role in promoting equitable use of water.

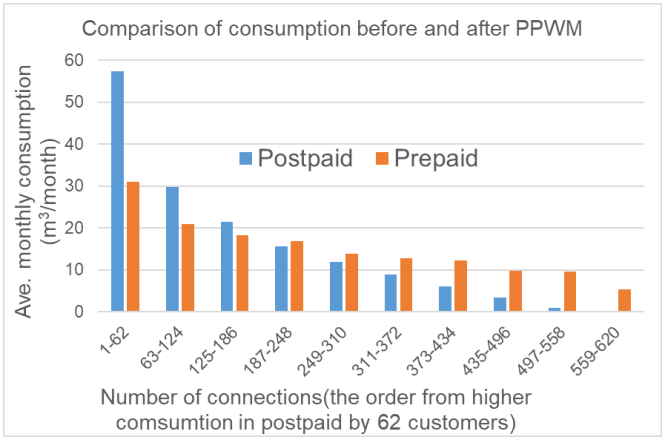


Figure 21 Comparison of water consumption of same customers in PA1 before and after PPWM installation

COVID-19 pandemic did not have impact on bill collection from PPWM

A comparison of PPWM and post-paid meter bill collection during the early stages of the COVID-19 pandemic is shown in Figure 22. During the early months of the COVID-19 pandemic, March-May 2020, there was a dramatic decrease in the rate of bill collection from post-paid meters. On the other hand, PPWM payment was unaffected; according to WWD, the revenue from PPWM at that time contributed to the continuation of water supply.

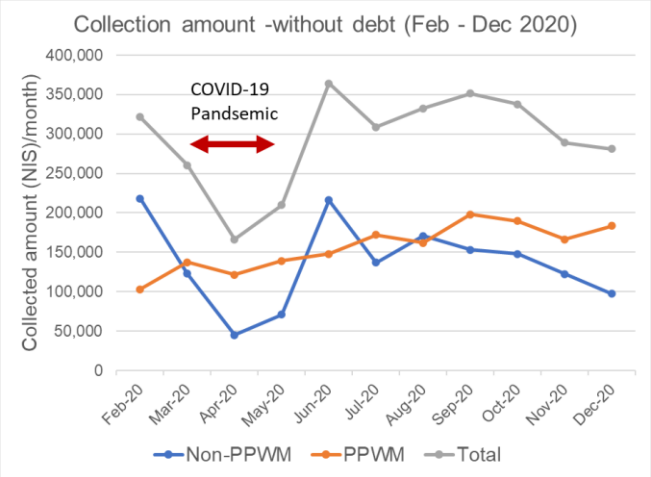


Figure 22 Comparison of revenue collection in post-paid and PPWM during COVID-19 pandemic

Increase in water supply time

A comparison was made between baseline and endline for whether water supply was available daily or not to the customers in the pilot area (Figure 23). In both winter and summer, most customers did not receive a regular daily water supply at baseline, but at endline, half of the customers received a regular daily water supply. This is due to the increase in water supply by NRW reduction, the leveling of water consumption of customers through PPWM and increase in water source by the use of private wells.

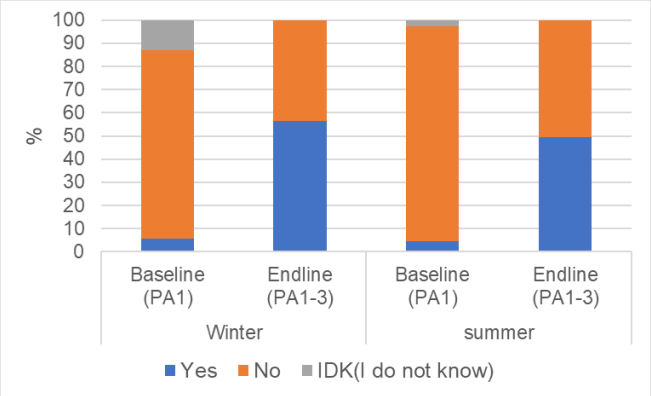


Figure 23 Access to water (daily or not) in baseline and endline by season

Improved Customer Satisfaction

The project improved customer satisfaction with water supply service by purchasing water from private wells to increase water supply and by improving customer service, including prompt response to complaints.

Customer satisfaction with water service (on a 5-point scale) in the pilot areas was compared between baseline and endline (Figure 24). In the baseline, "very low (1)" was indicated by 35%, while in the endline it decreased to less than 10%. In contrast, "high (4)" was indicated by less than 10% in the baseline but it increased to more than 30% in the endline. Customer satisfaction increased significantly after the project.

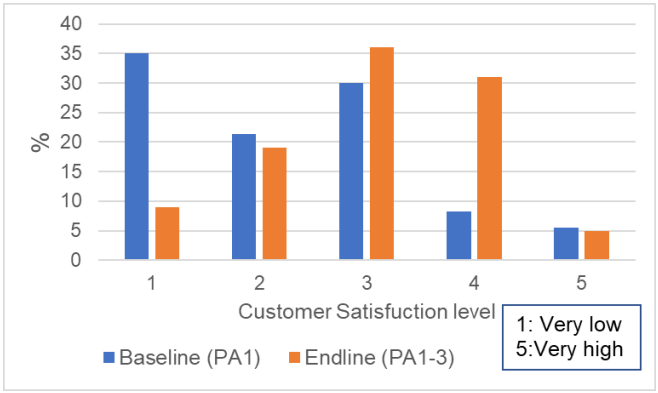


Figure 24 Customer satisfaction of water service in baseline and endline

Performance Indicators at a glance

The table below provides the Performance Indicators (PIs) in July 2022, which were prepared in the Project.

Table 13 PIs for July 2022

Indicators	Values
NRW	
Total System Input in entire city (m3/month)	351, 947
PA1 (%)	42.5
PA2 (%)	54.1
PA3 (%)	41.9
Entire City (%)	54.1
Leakage response time (days)	1.5
Customers	
Total number of customers	9,690
Total number of customers with mechanical meters	6,516
Total No. of Customers with installed PPWMs	3,174
PPWM	
% in total customers	32.7
PA1	737
PA2	538
PA3	533
Outside DMAs	1,111
Total customers rejecting PPWM in PAs and new DMAs	110
Data Entry	
Total No. of customers location/info in GIS system	3,694
Total No. of customers in AlShamel system	9,690
Total No. of assets registry in AlShamel system	NA
PPWM Random Check	
No. of checked/No. of discovered issues/No. of solved	800/174/174
Mechanical Meters 0-reading Check	
No. of checked/No. of discovered issues/No. of solved	540/170/170
Collection Campaign	
No. of visits/No. of positive responses	Paused
Customer Complaints	
No. of received complaints/No. of solved	802/802
Revisit of Rejected Customers	
No. of visited/No. of agreed/No. of installed	Paused
Collection Ratio % (average)	
PA1	90.9
PA2 without camp and institutions	91.8
PA3	90.0
All City	48.6
Type of PR Activities	
Social Media	536
Door to Door visits for pre-Installation of PPWM	Paused
Collected amount from Palpay system (ILS)	62,156
Collected amount from PPWM system (ILS)	9,719,405
Status of use of MBS (any issues)	Regular
Daily use of CSS's service car (average hours/day)	4.0-4.6

Various manuals, guidelines, plans, and reports as listed below, have been jointly prepared by the Experts and C/P. These will be valuable assets for future expansion of activities and further improvement of water services of Jenin Municipality.

BOX 5: Materials prepared as Project deliverables

1. Manuals, Guidelines and Plans- NRW

1.1 NRW Management Manual (Comprehensive Version)
1.2 NRW Management Manual (Basic Version)
1.3 Equipment Usage Manual (Standard version)
1.4 Equipment Usage Manual (Simplified version for Technician)
1.5 Cost-benefit Analysis of NRW Management Works
1.6 DMA & Roll-out Plan of NRW Reduction

2. Study report, Plans and Manuals – PPWM

2.1 Study on Existing Meter System and Prepaid Water Meter System and Feasibility and Strategy for Introduction of Prepaid Water Meter System
2.2 Implementation Plan of Introduction of Prepaid Water Meter System in Pilot Area-1 (PA-1)
2.3 PPWM Booklet – for customers
2.4 Case Study of PPWM in Jenin Municipality
2.5 Manual for Management of Prepaid Water Meter System in Jenin Municipality
2.6 Prepaid Water Meter Installation Plan for Entire City of Jenin

In addition, 28 other materials (manuals, guidelines & information, reports, plans, job descriptions, PR materials, and seminar presentations) were prepared mostly both in English and Arabic and some in English only.

PROJECT SUSTAINABILITY IS ENSURED

NRW management and PPWM installation are continued by the C/P based on the plans prepared to extend pilot project activities to the entire city. Additional 3 DMAs have already been constructed by the C/P and NRW activities have been started. The C/P started the installation activities immediately after the delivery of 4,350 PPWMs procured by JICA. In addition, Jenin Municipality plans to procure additional PPWM to cover the entire city including new customers. The Municipality also signed an agreement with the PPWM supplier on maintenance contract of PPWM which will further ensure the sustainability of the Project outputs.

6. Findings and Lessons Learned

A. NRW management

- **With assistance of the Experts, the C/P can become more proficient in the techniques and can develop locally adapted methods of solution.** In Jenin, it was difficult to apply the step test due to the fact that nighttime work is not allowed for security reasons, the supply is intermittent, and there is a lack of suitable locations for the study sites. Therefore, the C/P developed a stop cock-method adapted to the local conditions in Jenin. This method is found to be very effective to locate underground leakage and illegal connections.

B. Customer service management

- **Jenin Municipality in general were open to acceptance of digital solutions and overcame many challenges.** There may still be some challenges, however the C/P has gained many experiences with launching digital solutions. They will upgrade such solutions more in future.

- **Utilization of digital solutions helps improve operational efficiency**. Various digital solutions such as GIS, MBS, and tablets were utilized with corresponding increase in operational efficiency.

- **Water service providers must put significant efforts into PR activities** and motivate their staff to understand customer opinions (both positive and negative) in order to provide good services and satisfy customers.

C. PPWM management

- **By anticipating risks in advance and preparing and implementing countermeasures, opposition to the introduction of PPWM could be avoided**. Initially, it was assumed that there was a risk that PPWM might not be installed due to opposition to PPWM from residents. In order to reduce the risk and to ensure the success of the PPWM installation, a detailed survey, preparation of strategy (improvement of water supply conditions and services to increase customer acceptance of PPWM) and implementation plan, and public awareness campaign were conducted prior to installation, and the customers were dealt carefully even during the installation.

- **When introducing new advanced equipment, the experiences, lessons learned, and advice of experienced water service providers should be utilized**. Four other water supply providers that had already implemented PPWM were visited, their implementation procedures, challenges, and lessons learned were studied, and advice on how to implement PPWM in Jenin was obtained. The visits helped in preparation of PPWM introduction strategy.

- **Most suitable type of meter or any equipment should be selected, if necessary, by conducting demonstration experiment.** Three types of water meters, including ultrasonic water meters, were actually installed in 11 customers' houses for several months to compare and demonstrate the performance of the water meters. As a result of the experiment, the ultrasonic type was selected as the best water meter for PPWM in Jenin conditions.

- **Use of latest technology and tools should be encouraged**. Use of Gateway with LoRa technology to communicate with PPWMs and remote information gathering including water consumption data and warning proved to be very helpful in improving

customer service and calculating/ monitoring monthly NRW ratio.

- **PPWM can also address the problem of socially vulnerable group**; the impact of PPWM installation on the socially vulnerable (the poor) has been mitigated by using the PPWM as a post-paid meter with the valve always open. The tariff rate structure is being revised to offer lower water rates to customers who use less water (to cater to the socially vulnerable group), regardless of pre-paid or post-paid.

D. Organizational capacity development

- **For the capacity development project, it is necessary to first establish an organizational structure that enables capacity development activities.** There were insufficient number of technicians and engineers in the beginning, and the organizational structure was inadequate for carrying out the Project activities. Upon request from the Expert, the Municipality hired 2 young engineers and 6 technicians, and the Project trained them. This helped a lot in carrying out Project activities and achieve the desired result.

- **A C/P who was actively participating in the project was promoted to a key position in the project to drive the project forward.** An engineer (female) who had been actively participating in the project was promoted to the position of coordinator/deputy project manager to drive activities more actively by the C/P. At the end of the project, she became the Acting Director of WWD and Project Manager of the project. This established a structure to continue to sustain the project outputs. It also contributed to gender streamlining in the Project.

- **Ongoing communication and follow-up opportunities and monitoring are important for capacity development.** In this project, regular meetings ((bi-)weekly) were established to report the results of OJT and other activities, identify issues, and resolve them. A system was established to take minutes and follow up on the minutes of the previous meeting. This meeting system was implemented remotely during COVID-19 pandemic, and activities continued even during this period. In the latter half of the project, the C/P started to set performance indicators and compile them in monthly reports along with activity reports. Through these activities, the C/P's ownership of project operations was strengthened, and their ability to sustain activities, monitoring, and follow-up was improved.

- **Locally, there are many practices, experiences, and knowledge to be learned and adopted. It is worth exploring them for more effective training and improving the C/P capacity and the performance of water supply service.** The concept of training through study tour to other water providers is to study their good practices and apply them to Jenin's case, assessing and comparing their cases of practice with that of Jenin Municipality.

- **Team working and inter-departmental/sectional cooperation have considerable role in success and achievement of goals.** Project activities, especially the PPWM implementation, coordination and teamwork among Water Section (installation), CSS (operation) in WWD, IT Department (server management), Public Relations Department (public awareness activities), and Citizen Center (new connections) in the Municipality Office. Similarly, NRW activities also required coordination, including the Movement Department (heavy equipment and vehicle deployment), Collection Unit (bill and collection data), and the Legal Section (handling illegal connections). In addition, the Mayor and City Council were coordinated without delay in the necessary decisions and budget. Through the project activities, the collaboration of all departments and sections involved was strengthened and a general mobilization system (one team) was established, which greatly contributed to the achievement of the goals.

- **Digital data are vital for effective monitoring and planning of improvement measures**. A system was setup to digitally record and share data. This greatly helped in developing improvement measures, and monitoring of activities and indicators.

- **It is important to invest on managerial support tools, which** streamline the processes and enable staff to operate the Project with ownership and greater efficiency. They are crucial for establishment of clear workplans and supportive staff. For example, the services and work efficiency improved with transportation (motorcycle and car) and communication tools. Software and IT equipment (which improve services and improve efficiency) is important for capacity development.

References:

1: Record of Discussions on Project for Strengthening the Capacity of Water Service Management in Jenin Municipality, November 2016, JICA

2: The Joint Terminal Evaluation Report on the Project for Strengthening the Capacity of Water Service Management in Jenin Municipality, August 2021, Joint Terminal Evaluation Team (JICA, Ministry of Local Government (MoLG))

3: Completion Report of the Project for Strengthening the Capacity of Water Service Management in Jenin Municipality, October 2022, JICA

Project Period: From September 2017 to October 2022

Project Logo