Ex-Post Project Evaluation 2019：

Package Ⅰ-4 (Myanmar)

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JAPAN INTERNATIONAL COOPERATION AGENCY

GLOBAL GROUP 21 JAPAN, INC.
KAIHATSU MANAGEMENT CONSULTING, INC.

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Republic of Myanmar

FY 2019 External Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for National Single Window and Customs Modernization by Introducing Automated Cargo Clearance System"

External Evaluator: Hajime Sonoda, Global Group 21 Japan

0. Summary

The Project for National Single Window and Customs Modernization by Introducing Automated Cargo Clearance System (hereinafter referred to as "the Project") was implemented to establish the Myanmar Automated Cargo Clearance System (hereinafter referred to as "MACCS") and the Myanmar Customs Intelligence Database System (hereinafter referred to as "MCIS") to improve the efficiency of the customs clearance procedures,[1] thereby contributing to strengthening of the financial base through the facilitation of trade and customs revenue. The establishment of an electronic (computerized) cargo clearance system which enables the simplification, improved transparency and improved efficiency of the customs clearance procedures has been an important challenge faced by Myanmar at the time of both project appraisal and ex-post evaluation and the Project is highly consistent with the development policy and needs of Myanmar. The Project was also consistent with one of the pillars of Japan's country assistance policy for Myanmar, namely "assistance for the capacity development of human resources and development of a system to support Myanmar's economy and society" at the time of project planning. Therefore, the relevance of the Project is high. The outputs of the Project are generally as planned, the project cost was as planned, while the project period was shorter than planned. Therefore, the efficiency of the Project is high. In Yangon and Thilawa, the wide use of the e-declaration process through MACCS has somewhat shortened the customs clearance time but the actual time has not reached the level assumed at the time of project appraisal. On the other hand, the Project has achieved improved efficiency and transparency of the customs clearance procedures, improved accuracy and consistency of customs inspection, and intensified crackdown through inspection. All of these are synergy effects of the Project and the Technical Cooperation Project which have been implemented side by side. Based on the above, the Project is considered to have contributed to trade facilitation and strengthening of the financial base by customs revenue. Therefore, the effectiveness and impacts of the Project are fair. No major problems have been observed in the institutional/organizational, technical and financial aspects and the current status of the operation and maintenance of the Project. Therefore, the sustainability of the project effects is high.

In the light of the above, the Project is evaluated to be highly satisfactory.

[1] See 3.2.1 Project Outputs for more explanations on MACCS and MCIS.

1. Project Description

Project Location

Customs Clearance Procedures at the Yangon International Airport

1.1 Background

Since the inauguration of the new administration in March, 2011, the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar") has conducted various reforms in October 2011, including the relaxation of import restrictions on vehicles and lifting of the ban on foreign currency trading, in order to shift the conventional centrally controlled economy to a market economy. While conscious efforts have been made to develop the private sector, characterized by labour-intensive and export-oriented industries, through the encouragement of inward investment, the complicated administrative procedure has posed a barrier to such development. The customs clearance procedures were based on paper documents and the development of a modern customs clearance system, especially an electronic cargo clearance system, in Myanmar lagged well behind that of other ASEAN countries. Meanwhile, the strengthening of the revenue base and trade facilitation, including improvement of the efficiency of the customs clearance procedures, were essential to cope with the rapid increase of both the import and export volumes reflecting Myanmar's economic development. Moreover, in the face of the forthcoming regional integration of ASEAN in 2015, Myanmar faced an urgent need to develop a comprehensive customs system with the establishment of a National Single Window (NSW) in sight.[2]

Against this background, JICA dispatched individual experts from Japan Customs of the Ministry of Finance to the Myanmar Customs Department (MCD) of the Ministry of Finance in the period from 2012 to 2014 on the issue of customs clearance and the customs service. With the cooperation of Japan Customs, MCD examined a likely scheme for a desirable electronic customs clearance system for Myanmar which would utilize technologies associated with the Nippon Automated Cargo and Port Consolidated System (NACCS) and Customs Intelligence Database System (CIS) used in Japan. The Government of Myanmar then requested the Government of Japan to provide grant aid cooperation to realize the said system as well as technical cooperation for the development of

[2] "Single window" means the electronization of the customs clearance procedure. Application/notification can be conducted by single input/transmission to make the procedure simpler and smoother. In ASEAN, the establishment of an ASEAN single window was agreed in 2005 to mutually link national NSWs after the establishment of a NSW for the trading procedure in each member country for the purpose of exchanging and sharing information between exporting and importing countries.

institutional set-up and capacity building of the manpower necessary for the appropriate operation and maintenance of the system. In response, JICA started the Project of Capacity Development for National Single Window and Customs Modernization by Introducing an Automated Cargo Clearance System in Myanmar (hereinafter referred to as "the Technical Cooperation Project") in February 2014,[3] and later signed the Exchange of Notes (E/N) for the grant aid project (present project) in April of the same year.

1.2 Project Outline

The purpose of the Project was to establish the Myanmar Automated Cargo Clearance System (MACCS) and Myanmar Customs Intelligence Database System (MCIS) in order to improve the efficiency of the customs clearance procedures, thereby contributing to strengthening of the financial base through the trade facilitation and customs revenue.[4]

G/A Grant Limit / Disbursed Amount		3,990 million JPY / 3,990 million JPY
Exchange of Notes Date / Grant Agreement Date		April 2014 / April 2014
Executing Agency		Myanmar Customs Department (MCD), Ministry of Planning and Finance
Project Completion		November 2016
Project Area		Yangon, Thilawa (Thanlyin Township)
Project proponents	Main component	NTT DADA Corporation (software development; equipment procurement/installation)
	Consultant	Nippon Automated Cargo and Port Consolidated System, Inc.
Preparatory Study		October 2013 - March 2014
Related Projects		Dispatch of experts (Customs Clearance and Customs Service) (FY 2012 - FY 2014); Project of Capacity Development for National Single Window and Customs Modernization by Introducing Automated Cargo Clearance System in Myanmar (February 2014 - June 2020)

[3] The stated purpose of the Technical Cooperation Project was "Necessary environment for properly operating and maintaining MACCS/MCIS is enhanced with smooth introduction of the system based on the technology of NACCS/CIS towards Customs reform and modernization" while the stated overall goal was "Trade facilitation in Myanmar is further promoted with securing appropriate collection of Customs and Tariff". Using MCD as the counterpart with a cooperation period from February 2014 to June 2020, this project is assisting the establishment of capacity development to properly operate and maintain MACCS/MCIS, training of users in the private sector and expansion of the target area to include inland border regions among other things (the technical cooperation project is still in progress at the time of this ex-post evaluation).

[4] On the project appraisal sheet, the purpose of the Project is: "To improve the efficiency of the customs clearance procedure, including the introduction of NSW, by establishing MACCS/MCIS, thereby contributing to the reform and modernization of the customs administration". However, for the ex-post evaluation, those parts relating to the project impacts were modified in consideration of the background for the implementation of the Project stated on the project appraisal sheets, etc.

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda, Global Group 21 Japan, Inc.

2.2 Duration of the Evaluation Study

The ex-post evaluation study for the Project was conducted over the following period.

Duration of the Study: July 2019 - July 2020

Duration of the Field Survey: 16th September - 9th October, 12th - 19th December 2019

3. Results of Evaluation (Overall Rating: A[5])

3.1 Relevance (Rating: ③[6])

3.1.1 Consistency with the Development Policies of Myanmar

At the time of planning (2014), the Government of Myanmar adopted "the promotion of trade and investment as the growth engine" as one of its principal policies. Meanwhile, in the face of the forthcoming regional integration of ASEAN in 2015, there was an urgent need for the development of a comprehensive customs system with the establishment of the NSW in sight. The Myanmar Sustainable Development Plan 2018 - 2030 prepared by the Ministry of Planning and Finance in 2018 adopted "growth through the creation of employment and led by the private sector" as one of its targets. As a strategy to achieve this target, promotion of the reform of the trade sector as a member of ASEAN was called for along with a plan to proceed with the simplification, improved transparency and improved efficiency of the customs clearance procedures. With the assistance of donors, the Government of Myanmar is proceeding with preparations to establish the NSW while coordinating stakeholder government organizations (see the section on "Impacts"). Therefore, the Project is consistent with the development policy and plan of Myanmar at the time of both planning and ex-post evaluation.

3.1.2 Consistency with the Development Needs of Myanmar

As already described in "1.1 Background", the development of the strengthened revenue base together with smoother trade through the improved efficiency and prioritization of the customs clearance procedures was an important challenge for Myanmar at the time of project planning. The Customs Reform and Modernization Strategy 2017 - 2021 which is in place at the time of ex-post evaluation lists (i) modernization of the customs clearance procedures, (ii) development of the IT environment, (iii) organizational reform and human resources development and (iv) cooperation with the private sector as well as other government organizations as four target issues.

As MCD has been assisted by the Project as well as the Technical Cooperation Project, the customs clearance procedures at Yangon, Thilawa and some border crossing points have been computerized to improve the efficiency to some extent although computerization in other geographical

[5] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

[6] ①: Low; ② Fair; ③: High

areas is required in the coming years. The LPI-Customs score indicating the customs performance for Myanmar is 2.17 points out of a full 5 points (ranked 131st among 160 countries in 2018).[7] Although there is an improvement from the 1.97 points (150th) in 2014, it is still one of the lowest in the world. Because of this, the necessity for the Project is still maintained at the time of ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policies

At the time of planning, the Project was considered to fall under "assistance for the capacity development of human resources and development of a system to support Myanmar's economy and society" which was one of the three pillars of the Japan's country assistance policy for Myanmar (April 2012). As such, the Project is consistent with Japan's ODA policy. For the purpose of facilitating trade and foreign investment in Myanmar, the Government of Japan held the first meeting of the Japan-Myanmar Joint Initiative in March 2013, commencing the exchange of opinions on how to deal with various issues, including the speeding up as well as efficiency improvement of the customs clearance procedures.

Based on the above, the Project is highly relevant to Myanmar's development policies as well as Myanmar's development needs and Japan's ODA policies. Therefore, its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The work conducted under the Project included the development of a software to introduce MACCS/MCIS, procurement and installation of equipment, support for the introduction of a system and consulting services for the detailed design and procurement management.[8] Although some changes were made to the software specifications and the specifications, quantities and installation sites of equipment, the overall outputs were generally as planned (Table 1).

MACCS/MCIS is a system enabling the computerization of the customs clearance procedures and has functions to control cargo and to liaise with the relevant government organizations. It is used by the customs and other customs clearance-related government organizations (hereinafter referred to as "OGAs"), importing and exporting companies, airlines and companies relating to trade procedures and/or customs clearance (shipping companies, land transportation companies, customs brokers and logistics companies) among others. The principal functions of MACCS are those listed below (at the time of completion of the Project).

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[7] The LPI (Logistics Performance Index) measures the efficiency of international supply chains and is published by the World Bank every year. It converts multi-faceted evaluation results obtained from a questionnaire survey with more than 1,000 logistics operators throughout the world into a score and ranks 160 countries. The index evaluates the customs service, infrastructure, cost, quality, traceability and punctuality of each country.

[8] As the Technical Cooperation Project was implemented in parallel with the Project, technical assistance (soft component) was not provided within the scope of the Project.

Table 1 Planned and Actual Outputs

	Planned	Actual
Software	Software: one set	Generally as planned with the partial modification of the scope of work
Equipment, etc.	Hardware: one set	Generally as planned with the partial modification of the specifications, quantities and installation sites
Assistance for introduction of the system	Assistance for explanatory meetings, user application, system configuration, preparation of manuals, training of customs officers, private sector users and system managers and others	As planned (jointly implemented with the Technical Cooperation Project)
Consulting services	Detailed design and procurement supervision	As planned

- Cargo control function: This function registers information on the manifests of ships and airway bills of airplanes. It controls cargo movement to and from the customs control area and allows the real-time tracing of cargo movement.

- Import/export declaration and tax payment function: Declaration of import/export is made with such documents as invoice and bill of lading attached to cargo, using PDF format, etc. This function automatically judges inspection categories (simplified examination, document examination and actual inspection) corresponding to the risk, etc. of smuggling and illegal customs clearance of cargo. Once customs duty is paid by means of deduction from the deposit or direct payment after the completion of examination/inspection (in the case of import), a cargo release order is issued.

- Liaising function with OGAs: This function enables application, receipt or enquiry regarding an import/export licence through the system operated by the Ministry of Commerce, application for the inspection of imported animals/plants as well as imported foods/pharmaceutical products by a relevant government organizations (with the attachment of an application form in the Burmese language in PDF format) and registration of and enquiries about the inspection results.

Meanwhile, MCIS is a system to accumulate information on import/export permits, examination/inspection records, etc. which have been processed by MACCS and is only accessible by customs officers at the time of examination/inspection, at the time of customs clearance or for the purpose of supporting the customs service, including post clearance audit (hereinafter referred to as "PCA").

As far as the software for MACCS/MCIS is concerned, its schematic design was made through the Preparatory Study, with reference to a similar system in Japan (NACCS/CIS) owned and operated by NACCS as a model system, based on the basic design (2013) which was prepared through consultations involving Nippon Automated Cargo and Port Consolidated System, Inc. (NACCS), a developer of NACCS/CIS software, Japanese experts and MCD. This was followed by examination of

the necessity for and priority of various works to be included in MACCS/MCIS from the viewpoint of the speeding up of the customs clearance procedures and improvement of the control efficiency, etc. after a detailed study of the customs clearance procedures and other trade related administrative procedures in Myanmar by the working group set up by the Technical Cooperation Project. Based on the results of this examination, the consultant of the Project prepared the detailed design where the scope of work assumed in the schematic design were partially modified.

MACCS/MCIS connects the network host (group of servers) to the terminal units of private sector users as well as the terminal units of customs officers (350 units of which 200 units are paid for by MCD). This network host is installed at a data centre of the private sector and is connected to private sector users through the Internet, and to terminals of customs officers via base servers using dedicated lines of Myanmar Posts and Telecommunications (MPT). Originally, 11 sites were planned for the base server locations but the Myanmar Customs Training Institute was added in the light of the importance of the training of customs officers on MACCS/MCIS along with two other sites, i.e. the newly established Thilawa Special Economic Zone (SEZ) Customs Office and Ahlone International Port Terminal of Yangon Port, resulting in a total of 14 sites. In addition, a router for communication conversion was additionally installed to deal with the global IP address shortage to ensure connection between the network host and the Internet.

All of the modifications on software and hardware described above were necessary for the proper functioning of MACCS/MCIS and efficient implementation of the administrative procedures for international trade, including the customs clearance procedures, and are, therefore, judged to be reasonable.

The main contractor (NTT Data Corporation) and the consultant (NACCS) for the Project conducted the preparatory work for the introduction of MACCS/MCIS jointly with MCD and the Japanese experts under the Technical Cooperation Project.[9] The work conducted by MCD included a usage contract with a data centre, procurement of dedicated lines between the data centre and individual base servers, establishment of LAN at each base server site, procurement/development of a network for private sector users and selection/procurement of vendors for the maintenance of operation software and hardware. In August 2015 during the implementation of the Project, IT sections of MCD were integrated to the newly established MACCS Division which is responsible for the further development of MACCS/MCIS, operation and maintenance of MACCS/MCIS after its launch, and operation of the Help Desk. Trainers were prepared from among staff members of this division and explanatory meetings and the practical training for customs officers in the target areas of the system (approximately 400 persons) were conducted. Moreover, a brief explanatory meeting was repeatedly held for officials of the OGAs and private sector users in addition to the practical training of staff members of customs brokers (some 800 participants) on the software to operate MACCS terminals. From August to October 2016, the

[9] As this preparatory work was conducted under the Project and the Technical Cooperation Project in an integral manner, it is practically impossible to clearly determine the area of responsibility of the Project.

general operation test was conducted and MACCS/MCIS system was officially launched on 12th November, 2016.

According to MACCS Division, the target operating ratio adopted at the time of planning (99.9% or higher for MACCS and 99.4% for MCIS) were achieved during the period from the initial commissioning of the system in November 2016 to the ex-post evaluation (September 2019). Also achieved was the traffic processing time (an average of one second).[10] Consequently, MCD has highly evaluated the performance (quality) of MACCS/MCIS, i.e. the output of the Project.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned total project cost was 4.04 billion JPY (Japanese portion of 3.99 billion JPY and Myanmar portion of 50 million JPY). As the scope of the Project was re-arranged to make the project cost within the planned cost despite changes of the planned software and hardware, the actual project cost was 4.04 billion JPY (Japanese portion of 3.99 billion JPY and Myanmar portion of 50 million JPY) as planned.

3.2.2.2 Project Period

The Project was planned to be completed in 30 months from the signing of the consultant agreement to the acceptance inspection and handing-over. In reality, the project period was 28 months, which was shorter than the planned period, from the signing of the consultant agreement in August 2014 to the handing-over in November 2016. Although the work was delayed by such undertakings of the Myanmar side as the securing of a data centre and establishment of the network (dedicated lines) connecting the data centre and base servers, the overall project period was shortened, primarily because of the regularly held project progress meetings involving the consultant and main contractor for the Project, MCD and technical cooperation experts and also because of appropriate schedule control by the consultant.

Based on the above, while the project cost was as planned, the project period was within the plan. Therefore, the efficiency of the project is high.

3.3 Effectiveness and Impacts[11] (Rating: ②)

3.3.1 Effectiveness

The Project aimed at improving the efficiency of the customs clearance procedures by establishing MACCS/MCIS in Myanmar. The achievement of the indicators set at the time of planning

[10] Operating ratio = (operating time – down time) ÷ operating time. The down time excludes the system suspension time due to power failure, network failure, etc. while the operating time excludes the maintenance time and planned down time.

[11] The effectiveness is rated in consideration of not only the effects but also the impacts.

(quantitative effects) and other effects relating to the project purpose (qualitative effects) are analysed next featuring Yangon and Thilawa after clarifying the utilization situation of MACCS/MCIS up to the time of ex-post evaluation.

3.3.1.1 Situation of Utilization of MACCS[12]

In parallel with the design work for MACCS and examination of the e-declaration procedure, MCD has commenced reviewing the existing customs clearance procedures to improve and simplify them in line with the international rules set by the World Trade Organization (WTO), World Customs Organization (WCO), etc. The principal matters considered included the introduction of a tax payment system by self-assessment, post clearance audit, advance ruling system and bonded system and abolition of the advance payment of customs duty.[13] Other matters intrinsic to e-declaration using MACCS include the declaration of bonded transportation, preliminary declaration and introduction of an import/export processing system not requiring either examination or inspection by a customs officer (simplified examination).[14] Of these matters, the consultant and main contractor for the Project and the Japanese experts of the Technical Cooperation Project joined in the examination of those related to e-declaration by MCD.

At the start of the MACCS operation, there was some confusion originating from the insufficient preparation on the side of private sector users (mainly customs brokers).[15] As the Help Desk of MACCS Division could not deal with the situation on its own, a support centre was established under the Technical Cooperation Project to assist the Help Desk to handle enquiries from customs brokers and other relevant matters. This confusion calmed down some three months after the start of MACCS operation and the number of registered users of MACCS has increased from some 1,800 in 2016 to some 2,600 in October 2019. Half of these users are companies involved in import and export, and customs brokers and transporters account for approximately 20% each. Other users include OGAs, warehouse operators, airlines and shipping companies. In 2019, MCD prepared the Standard Operating Procedure (SOP), in addition to the existing manual, for the customs clearance procedures and cargo control for customs officers and private sector users as a user friendly handbook for the use of MACCS. Its first edition is expected to be widely distributed in 2020 after a trial period of three months for some users.

The target areas of the Project were originally Yangon City and Thilawa SEZ. However, MCD expanded the target operating areas of MACCS to include Myawaddy on the Thai border in June 2018

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[12] As MACCS and MCIS are operated in an integral manner, they are simply referred to as MACCS in 3.3.1.1 and subsequent sections of this ex-post evaluation report.

[13] The previous method was to make a declaration after the payment of the assumed customs duty and any shortfall as a result of examination by MCD was paid later if necessary.

[14] With this system, MACCS automatically selects the suitable inspection category (simplified examination, document examination or actual inspection) corresponding to the risk of the cargo to simplify the examination of low risk cargo so that examination/inspection focuses on high risk cargo.

[15] In an interview with the then President of the Myanmar Customs Brokers Association, it was revealed that half of customs brokers did not have a PC when MACCS was launched. Moreover, many private sector users did not participate in the general operation test which was conducted for a period of three months prior to the start of full-scale MACCS operation.

with the assistance of the Technical Cooperation Project. This was followed by secured funding for further expansion to a Chinese border site (Muse border trade zone).

After commissioning of the system, MCD, OGAs, the Japanese experts of the Technical Cooperation Project and the vendors examined the needs for improvement which became apparent through the actual operation of MACCS as well as the requests made by users, and implemented improvement measures in order of their urgency or importance. MCD secured the necessary budget to realize some of these measures, such as program modification, etc., which required additional cost.[16] MACCS contains some extra functions for their future use but these are not yet in operation as the conditions for their use have not yet been met.[17]

With MACCS, a bank paying-in record is used to register the amount of deposit to the system. When this amount is higher than the amount of customs duty, etc. to be collected, actual payment is made electronically after the completion of examination. Alternatively, direct payment to customs is possible by submitting a bank paying-in record for the amount of customs duty, etc. to be collected by the customs. Because of a request by many private sector users for direct on-line payment to MACCS from the bank account of a person requesting examination, the establishment of a link between MACCS and the settlement system of the Central Bank of Myanmar is being considered at the time of ex-post evaluation, as this link would make such direct on-line payment possible. The development of a system to enable this link is scheduled to take place in the second half of 2020 or later.

3.3.1.2 Quantitative Effects (Operation and Effect Indicators)

At the time of planning, "e-declaration rate" and "shortening of the customs clearance time (for import)" were listed as quantitative indicators to measure the degree of achievement for "the improved efficiency of the customs clearance procedures through e-declaration".

(1) E-declaration Rate[18]

In areas where MACCS was introduced, it was decided that only e-declaration would be accepted except for the declaration of cargo exceeding 200 different items at the same time which cannot be handled by MACCS. Because of this, the e-declaration rate is currently high. To be more precise, the rate has reached 96% in the target areas of the Project (Yangon and Thilawa SEZ), exceeding the target 90% at the time of planning (Table 2). In short, the degree of achievement regarding the e-declaration rate is high.

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[16] In general, any computer system is often required to adjust and modify its program as defects and requests for improvement surface after the commencement of its actual operation.

[17] Some of these functions are a link to the EDI (electronic data interchange system) of the Ports Department, handling of transits and electronic invoicing.

[18] The indicator at the time of planning as "the ratio of the number of e-declarations/value to the total number of declarations". As no data on the declared value is available at the time of ex-post evaluation, the e-declaration rate is simply analyzed based on the number of declarations.

Table 2 E-Declaration Rates for Import and Export in Yangon and Thilawa SEZ

	Export			Import			Combined
	Total Number of Declarations	Number of E-declarations	E-declaration Rate	Total Number of Declarations	Number of E-declarations	E-declaration Rate	E-declaration Rate
2016.11 - 2017.3 (5-month Period)	40,333	39,010	96.7%	109,079	105,246	96.5%	96.5%
2017.4 - 2018.3 (12-month Period)	111,891	109,163	97.6%	263,743	250,706	95.1%	95.8%
2018.4 - 2019.7 (16-month Period)	170,603	167,673	98.3%	310,109	292,664	94.4%	95.8%
Whole Period	322,827	315,846	97.8%	682,931	648,616	95.0%	95.9%

Source: Compiled by the evaluator using reference materials provided by MCD.

(2) Shortening of the Customs Clearance Time

Prior to the implementation of the Project, import and export declarations were entirely made by paper documents. Many declarers had to undergo document examination by many customs appraisers of MCD as well as cargo inspection by inspectors. Because of this, the customs clearance time for importation (time from initial declaration to receipt of a cargo release order) was 1 - 3 days for document examination alone or longer when inspection was involved. E-declaration under MACCS takes only several seconds to automatically determine which of three examination categories (simplified examination, document examination and inspection) the cargo in question must undergo depending on the risk level of the cargo. In the case of simplified examination, a cargo release order is issued immediately after the payment of customs duty. In other words, when the account balance on MACCS is above the payable amount of customs duty, a cargo release order is issued simultaneously with the categorization of cargo for simplified examination. Meanwhile, document examination can be conducted on-line by a customs appraisal officer using the document attachment function (PDF format, etc.) of MACCS but examination using the original document is still prevalent even after the introduction of MACCS as described later. When a declaration is judged to require inspection, an inspector checks the correspondence between the cargo described in the submitted document and the actual cargo.

At the time of planning, it was assumed that the implementation of the Project would shorten the customs clearance time in the case of simplified examination to three seconds and the time in the case of document examination to 2 - 4 hours. The target time for simplified examination assumed that sufficient account balance is registered with MACCS. The target time for document examination assumed that the attached document would be verified and screened in the form of an electronic file only.[19] There was no target time for customs clearance time in the case of inspection. In reality, as described below, the target times appear to have been achieved in the case of simplified examination when the account balance is above the payable amount of customs duty and in the case of declarations

[19] According to the Japanese experts of the Technical Cooperation Project, paperless declaration was intended at the time of the planning of the Project and the widespread use of original paper documents for verification was not anticipated.

at Thilawa SEZ which account for some 2% of the total number of customs declarations in the target areas of the Project. The planned target times appear to have not been achieved in other instances.

Yangon

According to the survey on the customs clearance time conducted by MCD in 2014 and 2019 at the Asia World Port Terminal (AWPT), the largest terminal of Yangon Port which handles 70% of trading cargo and 90% of container cargo in Yangon, the average customs clearance time (from declaration to the issue of a cargo release order) in 2014 was 72 hours. In 2019, the time was reduced to 59 hours, a reduction of some 20% from the 2014 level. By type of customs examination, simplified examination took 14 hours, document examination took 42 hours and inspection took 91 hours. As shown in Table 3, the degree of target achievement for shortening of the customs clearance time at the AWPT was 81% for simplified examination and 43 - 44% for document examination. As the overall target achievement rate (weighted average based on the number of samples for simplified examination and document examination) was approximately 61%,[20] the degree of target achievement is judged to be fair. Meanwhile, the customs clearance time for inspection slightly increased between these five years and this is believed to be attributable to the more thorough inspection of high risk cargo.[21]

Table 3 Changes on Customs Clearance Time at Yangon Port (AWPT)

Category of Examination	Reference Time in 2014	Actual Time in 2019	Time Shortened (Shortening Ratio)	Shortening Target	Degree of Target Achievement
	A	B	C = A – B	D	E = C / D
Simplified Examination	72 hours (no distinction of examination category)	14 hours	58 hours (1%)	72 hours	81%
Document Examination		42 hours	30 hours (42%)	68 - 70 hours	43 - 44%
Inspection		91 hours	(Increased)	None	Not applicable
Overall		59 hours	13 hours (18%)	None	Not applicable

Source: Compiled by the evaluator using the materials provided by MCD.

Note: The reference customs clearance time (A) was 24 - 72 hours at the time of planning (figures for simplified examination was not applicable because it did not exist at the time). In the ex-post evaluation, the result of the survey on the customs clearance time conducted at AWPT in 2014 (72 hours) is used. The shortening target (D) was set to be the time reduced for customs clearance (simplified examination: 72 hours → 3 seconds; document examination: 72 hours → 2 - 4 hours; inspection: none) in the case where the target time (simplified examination: 3 seconds; document examination: 2 - 4 hours; inspection: none) is achieved at AWPT.

[20] The time release study (TRS) at the AWPT checked 179 declarations (43 cases of simplified examination, 50 cases of document examination and 86 cases of inspection).

[21] See “Intensified crackdown through inspection” in 3.3.1.3 Qualitative Effects (Other Effects).

The results of interviews with MCD and private sector users generally suggest several factors for the partial failure to achieve a shorter customs clearance time at Yangon as described below.[22]

- Verification of original documents at the Head Office of MCD (relevant only to document examination or inspection)

  Only some 20% of declarations are classified in the category of simplified examination under MACCS. As inspection is based on document examination results, the remaining some 80% of declarations undergo document examination. In Myanmar, most document examination is conducted by submitting original documents which are attached to the declaration to the head office of MCD (customs office at an airport in the case of air cargo) except at Thilawa SEZ (described later). Although document verification itself takes less than 30 minutes to complete, there is additional time for a customs broker who must travel to the head office of MCD and queue for examination at the said office. When the submission of documents is not completed by around 15:00, the broker must wait until the next day.[23]

  Some 80% of the declarations for document examination and possible inspection are applications for tax exemption under a free trade agreement.[24] To prevent tax exemption fraud, MCD believes that it is important to verify the certificate of origin using the "original document". In the case of Japanese customs, verification of the certificate of origin is almost always conducted electronically and, if necessary, submission of the original document is requested after the completion of declaration examination. Japan has a well-structured PCA system (tax investigation by the customs after the customs clearance of imported cargo). In Myanmar, however, MCD adopts the verification of original documents as a matter of principle, as it emphasizes the shoreline control of illegal activities and safeguarding of customs revenue in the light of the prevalence of false documentation, large tax exemption amount (maximum of 40% of the customs duty; average of 9 - 10%) and infant state of the PCA system.[25]

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[22] As part of the ex-post evaluation, an interview was conducted with the Myanmar Customs Brokers Association, Myanmar International Freight Forwarders' Association, JETRO, two Japanese logistics companies, two Myanmar logistics companies and two Myanmar import and export companies.

[23] According to the time release study (TRS) at the AWPT, original document examination adds an average of 28 hours to the overall customs clearance time.

[24] Following the launch of the ASEAN Economic Community (AEC) in December 2015, the tariffs on most goods of which the origin is within the ASEAN were eliminated for intra-regional trading. While Myanmar officially joined the AEC on 1st January, 2019, tariffs had been eliminated earlier in accordance with the AEC rules in 2018.

[25] According to MCD, against the background of long economic sanctions from 1997 to 2016, various fraudulent import and export practices were rampant in the difficult situation. Fraud using false documentation and other illegal activities by the private sector were widespread to evade stringent trade control and crackdown by the government, resulting in a decline of the trust between the government and private sector. Meanwhile, some customs officers pointed out that widening of the scope of tax-exempt products in the AEC reduced the necessity to indulge in such fraudulent activities as under-declaring of the quantity to reduce the tax amount, reducing the number of such fraudulent activities. In ASEAN countries, the direct receipt of a certificate of origin by MACCS through connection with the ASEAN single window makes verification relying on original documents almost unnecessary. However, because of the cost of changing the program to enable this

In the interview with the Myanmar Customs Brokers Association, the opinions were expressed that "In view of the fact that each customs broker deposits some US$ 3,000, the standard practice should preferably be customs clearance first which is followed by verification of the original documentation and that any problem should be settled by the deposit in the case of a monetary problem or by the ex-post investigation system".

- Payment procedure for customs duties

When the balance of an account held in MACCS is found to be insufficient after the completion of examination, or the importer prefers direct payment of customs duties, some time is required to deposit into a bank and submit the bank payment record to the head office of MCD.[26] Customs clearance may be the next day depending on the timing of declaration. The situation is similar for simplified examination. With MACCS, the examination category is determined in several seconds after declaration but a cargo release order is immediately issued only when the account balance held by MACCS is above the payable customs duty. As such a case indicates, even though MACCS has a function to shorten the necessary time to complete payment, insufficient use by some users based on their own preference is affecting the customs clearance time.[27]

- Inspection by the OGAs

Food and pharmaceutical products require inspection by the Food and Drug Administration, Ministry of Health and Sports. This inspection involves the sampling of the cargo and analysis of samples at the Ministry's laboratory which takes several weeks to complete while the cargo is sealed and allowed to pass the customs clearance procedures. In the case of agricultural and fisheries products, inspection (quarantine inspection) is conducted by the Ministry of Agriculture, Livestock and Irrigation. This inspection is conducted in an area controlled by MCD primarily based on documentation. Such inspection by the OGAs is conducted prior to declaration, during examination or after the issue of a cargo release order depending on the type of cargo. Extra time, including waiting time, may be necessary as it requires witnessing by the customs broker concerned, making it impossible to be conducted in parallel with document examination, actual cargo inspection, etc. Moreover, there is a case where cargo which was declared not to require an import licence from the Ministry of

connection and other matters, it is currently uncertain when MACCS will be connected to the ASEAN single window.

[26] According to the time release study (TRS) at the AWPT, the customs clearance time is an average of five hours longer in the case of an insufficient account balance or an average of 16 hours in the case of direct bank bill payment compared to the case of a sufficient account balance. However, the ratio of an insufficient account deposit and direct bank bill payment is relatively low at 15% of all declarations.

[27] According to the Japanese experts working for the Technical Cooperation Project, many private sector users did not trust the deposit system at first and were reluctant to place a deposit.

Commerce is found during the examination process to require such a licence, forcing the importer to spend extra time obtaining and submitting such licence.

Thilawa SEZ

According to the results of the interviews with the customs office at Thilawa SEZ and logistics companies operating in Thilawa SEZ, the document examination time for imported cargo to this SEZ was reduced to 1 - 3 hours after the introduction of MACCS based on the examination of an attached electronic file in principle from some four days before the introduction of MACCS. Accordingly, it is inferred that the customs clearance time in the case of document examination plus inspection at Thilawa SEZ customs office is shorter than at other customs in Yangon. According to MCD, companies operating in Thilawa SEZ are believed to strictly adhere to the legal requirements because of the stringent examination of tenants by the operating body of the SEZ and, unlike other customs, the verification of original documents is not, in principle, considered necessary.

In the said interviews (with the Myanmar Customs Brokers Association, logistics companies, etc.) on the issue of the shortened customs clearance time by MACCS, many expressed the opinion that "although the overall examination at Thilawa SEZ and the declaration procedure for simplified examination (green channel) is completed faster than before, there is no real sense that the customs clearance time has generally been substantially shortened". In the light of the above, the degree of achievement by the Project of the target to shorten the customs clearance time is judged to be fair. At the time of planning, the target for a shorter customs clearance time for document examination was set with reference to the Japanese method which does not involve the verification of original documents. However, this target appears to have been rather over-optimistic for Myanmar where the verification of original documents is required due to the much greater risk of falsified documents than in Japan. On the other hand, from the viewpoint of trade facilitation and risk management, there is room for further consideration of whether or not verification of the certificate of origin using the original document without exception is the best way in Yangon.

3.3.1.3 Qualitative Effects (Other Effects)

According to the results of interviews with customs officers and private sector users of MACCS, the Project is considered to have achieved the following effects concerning the customs clearance procedures in addition to the e-declaration and shortening of the customs clearance time.

- Improved efficiency of the customs clearance procedures

The opinion of customs officers is that automated judgement of the examination category and automated calculation of the tax amount have reduced the responsibility of officers, lowering the sense of burden. Even in Thilawa SEZ where the number of declarations has been substantially

increased, the shorter clearance time has increased the number of declarations handled by each customs officer, resulting in restraint of the number of officers required. At some terminals of Yangon Port, the decreased number of required customs officers to examine import declarations during the day has enabled expansion of the night-time examination of import declarations, making this service available 24 hours a day.

At MCD, it has become easier to control and search a large number of documents. As the declaration records of individual import/export companies are stored in the system, an examiner can now quickly check past records if needed to judge the necessity for document examination/inspection and the scope of inspection.

Some private sector users point out that declaration can be efficiently prepared using information on past declarations. However, some say that the electronization (scanning) of documents to be attached, attachment of the scanned documents, printing of the declaration documents required for document examination or receipt of released cargo and other processes are all time-consuming and that the submission of original documents to the head office of MCD after e-declaration is repetitive.

- Improved transparency of the customs clearance procedures

Because the revision history of declared contents is entirely recorded, it has become difficult to fraudulently alter document contents which was a fairly common practice in the past. Some private sector users have expressed the opinion that the introduction of MACCS has clarified the flow of the customs clearance procedures and that it has become easier to predict the customs clearance time depending on the type of cargo. Moreover, the fewer face to face meetings between customs brokers and customs officers have reduced the habit of giving officers a small gratuity.[28]

- Improved accuracy of examination and declaration

At MCD, tax calculation which used to be manually conducted has now been automated, reducing the number of calculation errors. In addition, automated confirmation of items requiring the approval of the OGAs based on individual item codes has reduced the number of oversights. On the side of private sector users, the number of mistakes in the entries of e-declaration is reduced as an incorrect entry prompts an error message.

- Improved consistency of examination

The automatic selection of a declaration category by MACCS has reduced judgement variations by customs officers, improving the consistency of examination. Even though there are instances where document examination is changed to inspection or simplified examination is changed to document examination/inspection because of the judgement of an examiner after automated selection, the consistency of the overall examination process is believed to have been improved.

[28] According to customs brokers, the signatures of many customs officers were required to complete the customs clearance procedures in the past and that it was a common practice to give each officer a small gratuity.

➢ Intensified crackdown through inspection

The target cargo for inspection was previously selected by lottery and there was no firm basis for the selection of the inspection method for each cargo.[29] Since the introduction of MACCS, the examination category is judged based on risk evaluation of the cargo using import/export permit data as well as examination and inspection records accumulated by MCIS, making it possible to conduct inspection which prioritizes higher risk cargo. The lower number of cargo subject to inspection means the allocation of more time to inspection and the adoption of an appropriate inspection method which corresponds to the type of cargo as instructed by MCIS. According to MCD, the introduction of MACCS has led to the intensified crackdown through inspection as described above.

3.3.1.4 Summary of Effectiveness

MACCS has been operating adequately and is widely used in Yangon and Thilawa. Even though shortening of the customs clearance time has generally been achieved, the actual shortening has not reached the assumed level at the time of planning except in the case where the account balance exceeds the tax amount for simplified examination and in Thilawa SEZ, due to partial retaining of such procedures as the verification of original documents. Meanwhile, some positive achievements are believed to have been made in terms of the efficiency and transparency of the customs clearance procedures, accuracy and consistency of examination and intensified crackdown through inspection. In the light of the above, the degree of achievement of the project purpose of "improved efficiency of the customs clearance procedures through e-declaration" is judged to be fair.[30] As the Project and the Technical Cooperation Project have been planned and implemented in an integral manner with close collaboration, all of the effects described above are the synergized effects of the two projects.

3.3.2 Impacts

3.3.2.1 Intended Impacts

The main impacts expected of the Project were "trade facilitation" and "strengthening of the financial base through customs revenue".

(1) Trade Facilitation

Yangon

According to the time release study (TRS) at the AWPT, the customs clearance time in 2019 was an average of 59 hours. In addition to this, 149 hours were spent from port arrival to declaration and 12 hours were spent from the release order to physical release, resulting in a total time from port arrival to the release of cargo of 220 hours (9 days and 4 hours) which is 1.4 times of the total 157 hours (6 days and 13 hours) in 2014. Since the introduction of MACCS, the customs clearance

[29] There are many different inspection methods, including X-ray inspection and the partial/total inspection of actual cargo.

[30] For reference, the LPI-Customs Score of Myanmar was 2.17 in 2018 (ranked 131st of 160 countries), showing a slight improvement from 1.97 points in 2014 (ranked 150th) as already mentioned in "Relevance".

time is shorter than that in 2014 but the time from port arrival to declaration and the time from the release order to physical release have increased by 64 hours and 11 hours respectively.

While it is necessary to further check the causes of the longer time from port arrival to declaration, the following reasons have surfaced through interviews with MCD and private sector users.

- While import declaration using MACCS compulsorily requires the registration of cargo information to MACCS, the time-consuming registration of cargo information by the Myanmar Port Authority with MACCS sometimes hinders swift declaration.
- Because port warehouses allow the storage of cargo for up to 7 days without additional charge, an importer may delay declaration because of its own reasons, such as the lack of availability of a means of transportation (trucks, etc.) or warehouse space to store the released cargo.

One of the reasons for the long time required from a release order to physical release is the need for a printed release order document to be signed by a customs officer. According to MCD, this signature is required by the Central Bank in order to realize bank transfer of import fees, and is not a required procedure by the customs. MCD is modifying the relevant program of MACCS to eliminate this procedure so that release orders can be directly browsed by the Central Bank and other related government organizations.

In the light of the above, the customs clearance time at the AWPT has been somewhat shortened by the Project but cargo distribution cannot be said to have been speeded up due to other reasons.

Thilawa SEZ

Before the introduction of MACCS, the customs clearance procedures at Thilawa SEZ which was opened in 2015 was handled by the Thilawa Customs Office located outside the SEZ. Through the Project, with the connection of MACCS to the customs office inside the SEZ, the customs clearance time has been considerably shortened as described earlier.[31]

Linkage with OGAs

MACCS has a linkage function with OGAs and is partially used for the applications, acceptances and enquiries relating to import/export licences through the system of the Ministry of Commerce, applications for the inspection of imported animals and plants as well as imported food and drugs by the relevant government organizations and registration and enquiries relating to inspection results, etc. However, because of the slow deregulation of such government

[31] The Thilawa Container Terminal constructed with a Japanese ODA loan and which opened for business in May 2019 is expected to improve physical distribution related to Thilawa SEZ. The opening of a new customs office at this terminal is scheduled to take place by the end of 2019.

organizations and the slow progress of the collaboration among them, the linkage function of MACCS with other government organizations has not been sufficiently used.

In regard to a trade-related procedures linking more government organizations of Myanmar, the Blue Print which presents the overall concept of NSW and technical requirements has been announced with the assistance of the World Bank. In this Blue Print, the expectation that MACCS and MCD will play a central role in realizing NSW in Myanmar is repeatedly mentioned, as it is believed that the connection between the systems of the related government organizations will be built around MACCS which has a proven operational performance. The introduction of MACCS provided the opportunity for MCD to assume leadership in a series of discussions aimed at identifying the actual needs of the related government organizations as well as the private sector towards trade facilitation and coordination between stakeholders, generating the momentum to achieve NSW. Nonetheless, the reality in Myanmar is that spontaneous coordination among ministries cannot be expected and that there is no concrete prospect of the realization of NSW. Despite of this, there is no doubt that the introduction of MACCS by the Project and the Technical Cooperation Project has played an important role towards the realization of NSW.

Non-tariff barriers

In the 2018 JETRO Survey on the Business Conditions of Japanese Companies in Asia and Oceania, 53% of Japanese companies operating in Myanmar replied that there were non-tariff barriers hampering their business. This ratio is the second highest after Indonesia among the target countries of the survey. By type of barrier mentioned, the highest was import restrictions (obligation to register as an importer; import licence system; restrictions on quantity; import charges) at 31%.

As described above, the Project is believed to have contributed to trade facilitation in Myanmar through shortening of the customs clearance time. However, further trade facilitation requires the early realization of NSW and conscious efforts to tackle logistic issues and other issues such as the existence of non-tariff barriers, which cannot be dealt with by MCD.

(2) Strengthening of the Financial Base Through Customs Revenue

According to MCD, the overall trade value (in US$) increased by approximately 33% in the last five years. The real tariff rate fell from approximately 15% to approximately 11% in the same period due to widening of the scope of tax exemption based on free trade agreements (FTA) with ASEAN countries and others. The customs revenue in US dollars dropped by approximately 4% in the last five years.[32]

[32] Because of fluctuations of the foreign exchange rate, the customs revenue in Kyats increased by approximately 38% during the same period. The customs revenue of 523.8 billion kyats in FY 2017 accounted for 23% of the total tax revenue of the Government of Myanmar (approximately 2,300 billion kyats) in this fiscal year.

Meanwhile, MCD has enforced the strict crackdown of tax evasion using forged documents, etc. As described earlier, the introduction of MACCS is believed to have helped the intensification of crackdown, suggesting the possibility of its contribution to the securing of customs revenue. However, it is difficult to quantitatively verify this possibility in this ex-post evaluation based on the information obtained.

3.3.2.2 Other Positive and Negative Impacts

There are no notable impacts of the Project in terms of the environmental and social aspects.

In summary, the Project has achieved its objectives to some extent. Therefore, the effectiveness and impacts of the Project are fair.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional Aspects of Operation and Maintenance

Taking the opportunity of the introduction of MACCS, the Government of Myanmar began to modernize the customs clearance procedures in line with international rules and to improve the efficiency of declaration. Its efforts are continuing with the preparation of the Customs Reform and Modernization Strategy 2017 - 2021. MACCS was introduced in November 2016 for the target operation areas of Yangon and Thilawa. In June 2018, it was rolled out to Myawaddy on the Thai border and is currently expected to be further rolled out to Muse on the Chinese border as part of the plan to extend MACCS to cover the entire country. Based on such achievements, the policy and institutional environment for the continued utilization of MACCS is believed to be in place at the time of ex-post evaluation.

MCD has eight divisions under the Director General and two Deputy Director Generals, and has some 2,000 staff members (as of September 2019) nationwide. In June 2015, with the assistance of the Technical Cooperation Project, MCD established MACCS Division responsible for the operation and maintenance of MACCS, absorbing the ICT Section of the Administrative Division. At the time of ex-post evaluation, MACCS Division has 79 staff members (as of September 2019), including the division head and two deputy division heads, and conducts the operation and maintenance of MACCS/MCIS with the cooperation of entrusted system operation and maintenance companies (vendors) which are on contract. The Help Desk established in the Division handles enquiries from customs officers and private sector users. According to the Division, there are no problems regarding staff strength even though there are some unfilled positions. While coordinating the work within MCD and with related government organizations through a working group set up in the Division to conduct joint work with the Technical Cooperation Project, the Division is involved in various types of work, including the addition of hardware, program modification (software development), preparation of a standard operating procedures (SOP) for the work under MACCS, training of MCD staff of the Export and Import Control Division, Investigation Division and Finance and Inspection Division, all of which

use MACCS/MCIS, and opinion exchange with the private sector. Based on the above, there are no problems regarding the institutional aspect of the operation and maintenance of the Project.

3.4.2 Technical Aspects of Operation and Maintenance

Since the establishment of MACCS Division in June 2015, MCD has been continually training personnel of the said Division with the assistance of the Technical Cooperation Project while dealing with daily issues. By the time of ex-post evaluation, the Division had experienced several changes of the program, extension of the service area to Myawaddy on the Thai border and preparatory work for hardware upgrading scheduled to take place in 2021. Through a series of such work, MCD is believed to have acquired the basic capability to continually operate and maintain MACCS/MCIS in the coming years. As described here, the Technical Cooperation Project (scheduled to end in June 2020) which has been in progress since February 2014 to the time of ex-post evaluation has contributed to strengthening the operation and maintenance capability. At the time of ex-post evaluation, MACCS Division properly operates and maintains the system through the vendors and there does not appear to be any problems with the operation and maintenance of the Project (MACCS itself).

As far as the training of customs officers regarding MACCS is concerned, there is week-long training for those with no previous experience of MACCS. Week-long training targeting senior officers is also conducted several times a year. It has been pointed out by private sector users that frontline customs officers with no previous experience of MACCS appear to take some time to become accustomed to its operation. There is also the opinion that half of the frontline customs officers are not well familiar with MACCS. Those officers unfamiliar with MACCS conduct their work while learning how to operate MACCS from more experienced officers. There has been a case of a customs office with few officers familiar with MACCS because of frequent personnel changes. Such a situation at the frontline suggests a need to further intensify MACCS training for customs officers. Meanwhile, the capability of those working at the Help Desk answering telephone enquiries about the system is highly appraised by customs officers and private sector users of MACCS.

To ensure more active use of MACCS in the future, it is desirable to properly address such issues as expansion of the scope of services handled by MACCS, further improvement of the efficiency of the customs clearance procedures through a review of the existing MACCS-related work, solving of various practical problems to achieve the facilitation of trade and promotion of the NSW initiative through coordination with relevant government organizations. For the successful completion of these challenges, further strengthening of not only MACCS Division but also MCD as a whole is necessary even after the completion of the Technical Cooperation Project as planned. For this purpose, utilization of Japan's experience of its comparative system (NACCS/NCIS), which is the model for MACCS/MCIS, should prove useful.

Based on the above, although the necessity to consolidate the training of customs officers and to enhance the overall capability of MCD can be pointed out to ensure the more active use of MACCS, there appears to be no problem with the technical aspect of the operation and maintenance of the Project.

3.4.3 Financial Aspects of Operation and Maintenance

After the completion of the Project, the Ministry of Finance allocated the operation and maintenance budget for MACCS/MCIS, including commission for the external assignment of its maintenance (based on a contract with each vendor), in response to a budget request by MCD. On its part, MCD has secured the necessary budget for its work, such as modification of the program, expansion of the service area to include Myawaddy and Muse, and renewal of equipment at the network host in 2021, which is the 5th year of operation, from the National Treasury with parliamentary approval. As such, there are no problems regarding the financial aspects of the operation and maintenance of the Project. The budgeted expenditure of MACCS Division since FY 2016 is shown in Table 4.

Table 4 Budgeted Expenditure of MACCS Division of MCD

(Unit: million kyats)

	Expenditure
FY 2016 (April 2016 - March 2017)	4,353
FY 2017 (April 2017 - March 2018)	3,636
Fiscal Year Adjustment Period (April - September 2018)	2,322

Source: MCD
Note: 1 kyat = 0.071 JPY (September 2019)

MCD collects a handling fee of 30,000 kyats (approximately 2,100 JPY) per e-declaration to MACCS. This fee level is said to have been set to cover the estimated MACCS operation and maintenance cost in the first five-year period of operation (including the hardware renewal cost), taking the estimated increase of the number of declarations in the said period into consideration. In accordance with the regulation of Myanmar that all fees for government services are paid into the National Treasury, this customs operation revenue is paid into the National Treasury.

3.4.4 Current Status of Operation and Maintenance

Both the hardware and software of MACCS/MCIS have been properly operated and maintained. Although the system has stopped several times due to a fault with the exclusive lines provided by Myanmar Posts and Telecommunications, it has not stopped due to any fault of its own. The system has achieved high reliability of 99.9% and the target average traffic processing time of one second has been achieved.[33] Therefore, there are no problems regarding the operation and maintenance situation of the Project.

No major problems have been observed in the institutional/organizational, technical, financial aspects and the current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

[33] See 3.2.1 Project Outputs for the summaries of MACCS and MCIS.

4 Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented to establish MACCS and MCIS to improve the efficiency of the customs clearance procedures, thereby contributing to strengthening of the financial base through the facilitation of trade and customs revenue. The establishment of an electronic (computerized) cargo clearance system which enables the simplification, improved transparency and improved efficiency of the customs clearance procedures has been an important challenge faced by Myanmar at the time of both project appraisal and ex-post evaluation and the Project is highly consistent with the development policy and needs of Myanmar. The Project was also consistent with one of the pillars of Japan's country assistance policy for Myanmar, namely "assistance for the capacity development of human resources and development of a system to support Myanmar's economy and society" at the time of project planning. Therefore, the relevance of the Project is high. The outputs of the Project are generally as planned, the project cost was as planned, while the project period was shorter than planned. Therefore, the efficiency of the Project is high. In Yangon and Thilawa, the wide use of the e-declaration process through MACCS has somewhat shortened the customs clearance time but the actual time has not reached the level assumed at the time of project appraisal. On the other hand, the Project has achieved improved efficiency and transparency of the customs clearance procedures, improved accuracy and consistency of customs inspection, and intensified crackdown through inspection. All of these are synergy effects of the Project and the Technical Cooperation Project which have been implemented side by side. Based on the above, the Project is considered to have contributed to trade facilitation and strengthening of the financial base by customs revenue. Therefore, the effectiveness and impacts of the Project are fair. No major problems have been observed in the institutional/organizational, technical and financial aspects and the current status of the operation and maintenance of the Project. Therefore, the sustainability of the project effects is high.

In the light of the above, the Project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations for the Implementing Agency (Myanmar Customs Department)

(1) In response to the expectations of importers and exporters to further shorten the customs clearance time and to improve the convenience of the customs procedures, MCD should review the current customs procedures and operations related to import/export declarations and should address the following issues.

- Enhancement of PCA
- Further utilization of the attachment function of MACCS (confirmation of attached documents on screen)

- Examination/inspection taking into consideration import/export records and examination/inspection results in the past
- Advanced selection processing based on the risk management method
- Realization of the electronic payment (on-line payment) of customs duties

(2) Based on the operating experience over the three years, MCD should tackle the following issues to develop a training scheme which allows on-site customs officers to always be equipped with the latest knowledge of MACCS/MCIS.

- Development of more practical and effective training methods and training materials for newly appointed customs officers and those who have no previous experience of working with MACCS/MCIS
- Introduction of brush-up training for staff with experience of using MACCS/MCIS in the field in view of the regular updating of their knowledge

(3) MCD has been exchanging opinions with private organizations as required. While, it is suggested that a mechanism for the regular exchange of opinions with private organizations should be created at MCD, since an improvement in public administrative services would require accurate understanding on the needs of the private sector and a relationship of trust with the private sector build over time. For this purpose, the case of NACCS in Japan for which Nippon Automated Cargo and Port Consolidated System, Inc. provides a platform for the exchange of information and opinions of trade-related companies should prove helpful.

(4) MCD should continue its cooperation with trade-related governmental organizations in relation to the establishment of the NSW and use of the TIN number of the Revenue Department for customs declaration.

4.2.2 Recommendations for JICA

(1) JICA should examine the continuation of the technical cooperation after the completion of the Technical Cooperation Project in June 2020 to support the implementation of the above recommendations for MCD.

(2) JICA, together with JETRO and the Embassy of Japan, should continue its approach to the upper echelons of the Government of Myanmar through the Japan-Myanmar Joint Initiative in order to drive forward the clarification of the political will on the Myanmar side on inter-governmental cooperation towards the establishment of the NSW and other issues.

4.3 Lessons Learned

Continuation of technical cooperation after the introduction of the system

The Technical Cooperation Project which was implemented in line with the development and introduction of MACCS/MCIS by the Project assisted various preparations and capacity development for the introduction of the system. After the commissioning of MACCS/MCIS, the Technical Cooperation Project, by helping solve various operational problems such as setting up a support centre to deal with confusion at the time of launching the system, reviewing operational aspects, modification of programs, expansion of target area, hardware update and so on, has been continuing for approximately three and a half years, contributing to the strengthening of the capacity for the operation, maintenance and active utilization of MACCS/MICS by MCD and also to the enhancement and continued sustainability of the project effects.

The experience described above suggests a need to note that there are many issues which only surface through the actual operation of the system when the development and introduction of a new system is intended. It is also necessary to continue technical assistance for a certain period after the commissioning of the system so that issues which surface during operation can be properly dealt with.

Examination of the operating conditions of the system and setting of targets

For the Project, the target for the reduction of the customs clearance time was set, assuming paperless operation with the Japanese system in mind. In reality, however, some 80% of the declarations are dealt with using original documents in response to the operating principle adopted by the Myanmar side and, therefore, the target level for a reduced customs clearance time was not achieved.

Based on this experience, when a system which models a Japanese system is to be introduced for the purpose of improving an administrative service in the recipient country, it is essential to clarify the operating conditions of the system which enable the full achievement of the expected improvement effects while identifying differences regarding the administrative service in question and its operation between the two countries. It is also necessary to sufficiently confirm the willingness and commitment of the recipient country to achieve the improvement effects. Given the fact that the introduction of a new system is, by definition, a new experience for a recipient country, it is not easy to develop a concrete image of system operation until such time when the development of the software used by the system starts to allow visualization of operation screen, etc. For this reason, it is necessary to remember that the operating conditions may require reviewing as development of the system concerned progresses. Moreover, when operation differs from the comparative case in Japan, it is necessary to establish indicators and target values which correspond to the assumed actual operating conditions in the recipient country. There are several ways to deal with such a situation, including (i) changing of the target values at the stage when the actual operating conditions come into sight and (ii) setting of conditional target values which clarify the firstly assumed operating conditions.

Republic of the Union of Myanmar

FY2019 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Improving Loikaw General Hospital in Kayah State"

External Evaluator: Tomoko Tamura, Kaihatsu Management Consulting, Inc.

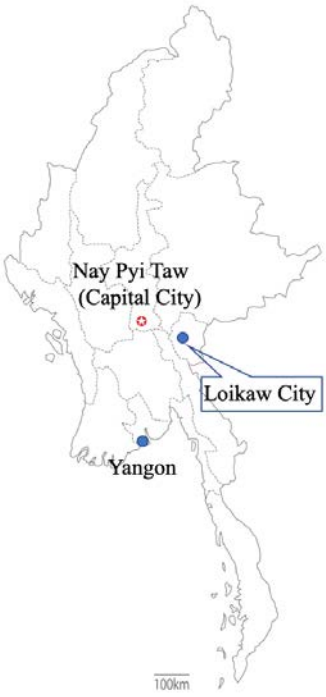
0. Summary

This project was implemented to improve the medical services of Loikaw General Hospital (hereinafter referred to as "the hospital") in Kayah State by providing facilities and medical equipment.

Improving the quality of health and medical care services was a priority issue in Myanmar from the time of project planning until the time of the ex-post evaluation. There was a need to enhance specialized medical services of the state and regional hospitals in the country. Therefore, the project was consistent with the development policy and development needs of the country. This is highly relevant with Japan's ODA policy of supporting the development of health and medical services to improve the lives of the people. And therefore, the relevance of the project is high. Two buildings were constructed, and medical equipment was procured and installed as planned. Although the project cost was within the plan, the project period was longer than planned; therefore, the efficiency of the project is fair. The numbers for outpatients, in-patients, deliveries, and operations with general anaesthesia, which were the indicators of the effectiveness of the project, increased significantly and achieved their targets. The status of utilization of the facilities and equipment provided by the project is also positive. The expected effects, such as improvement of medical services, hygiene and medical environment; patient satisfaction at the hospital; and rationalization of the referral system, which was expected as an impact of the project, were achieved. The project has achieved its objectives; therefore, effectiveness and impact of the project are high. No problems have been observed in the institutional/organizational, technical and financial aspects of the operation and maintenance of the facilities provided by the project. Although there is a shortage of anaesthesiologists and specialized staff for the maintenance of medical equipment, these are being addressed as priority issues; there is a prospect for improvement. Therefore, the sustainability of the project effects is high.

In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location

Loikaw General Hospital - New West Building

Health Education for Hospital Users

(Photos were taken at the time of the ex-post evaluation.)

1.1 Background

At the time of project planning, infectious and perinatal diseases accounted for a high percentage of the disease structure in Myanmar. In addition to this, lifestyle-related diseases and trauma were also increasing, and the disease structure of the country was at a turning point. For this reason, it was urgent to develop the state and regional hospitals that provided specialized medical services in each area of the country, in addition to enhancing primary health care for infectious disease control.

The hospital is the only general hospital in Kayah State, which has a population of approximately 290,000 (2014).[1] This is the only hospital in the state that has specialist doctors and emergency services. Many patients in the southern part of the Shan State, which is next to Kayah State, also visit the hospital. Regardless of these circumstances, its buildings were old and medical equipment was in short supply and obsolete. In addition to these, it had a higher priority for development among the provincial hospitals in the country. Compounding these factors, the hospital was selected for this project.

[1] Public hospitals in the country are categorized as national hospitals, state/regional general hospitals, district hospitals, township hospitals and station hospitals.

1.2 Project Outline

The objective of this project is to enhance medical services of the hospital, which is located in the capital city of Kayah State, by improving its facilities and medical equipment, thereby contributing to strengthening its function as a core hospital of the region.

Grant Limit /Actual Grant Amount	1,945 million yen / 1,572 million yen
Exchange of Notes Date /Grant Agreement Date	March 2014 / May 2014
Executing Agency	Ministry of Health (Changed to the Ministry of Health and Sports on May 25, 2016)
Project Completion	December 2016
Target Area	Loikaw City, Kayah State
Main Contractors	Contractor: TODA Corporation Procurement of equipment: Mitsubishi Corporation
Main Consultants	Yamashita Sekkei, Inc/ ITEC (Joint Venture)
Preparatory Survey	September 2013 – May 2014
Related Projects	・ Health System Strengthening Project (November 2014 – December 2018) ・ The Project for Human Resource Development of Medical Engineering (May 2018 – April 2023)

2. Outline of the Evaluation Study

2.1 External Evaluator

Tomoko Tamura, Kaihatsu Management Consulting, Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: July 2019 – June 2020

Duration of the Field Study: October 1 – 11, 2019; November 24 – 30, 2019

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Myanmar

National Health Policy 2030 and *National Health Plan 2011-2016*, the health policy and plan of Myanmar at the time of project planning, and *National Health Plan 2017-2021*, the health policy and plan at the time of the ex-post evaluation, aimed to improve the quality of medical services. Hence, the objective of the project, which was to improve the medical services of the hospital by improving facilities and equipment, was consistent with the country's health policy from the time of planning to the time of the ex-post evaluation.

3.1.2 Consistency with the Development Needs of Myanmar

At the time of planning and ex-post evaluation, it was important to enhance the medical services of the state and regional hospitals which provide specialized medical services in each region, in addition to enhancing primary health care for infectious disease control, as a result of an increase in lifestyle-related diseases in the country.

As described in “Background”, the hospital was a core hospital in the region. However, at the time of planning, the buildings of the hospital were old, medical equipment was seriously in short supply and obsolete. Moreover, there was not enough space in the buildings. It was reasonable to have selected this hospital for assistance from the project, because there was a great need for improvement. The hospital was still the only general hospital in the state at the time of the ex-post evaluation. The hospital was upgraded from a 200-bed hospital to a 500-bed hospital in 2015, indicating its importance in the region. In this way, the project has been consistent with the development needs of the country and Kayah State at the time of planning and ex-post evaluation.

3.1.3 Consistency with Japan’s ODA Policy

This project fell under the specific program of “improving health and medical services” for supporting the improvement of the livelihood of citizens, which was a priority area in the *Myanmar Economic Cooperation Policy* (April 2012) of the Ministry of Foreign Affairs of Japan. Therefore, the project was consistent with the ODA policy of Japan at the time of planning.

As mentioned above, this project has been highly relevant to Myanmar’s development plan and development needs, as well as Japan’s ODA policy. Therefore, its relevance is high.

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ②: Fair, ①: Low

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

As shown in Table 1, the output of the project was almost as planned. The floor area was slightly reduced because the location and layout of the facility were changed to improve user friendliness and privacy of the users.[4]

Table 1 Main Outputs of the Project <Development of the Facilities>

Item	Structure (plan and actual are the same)	Facilities (plan and the actual are the same)	Floor area (m^2)	
			Plan	Actual
New East Building	Two stories Reinforced concrete structure	Outpatient departments (general, internal medicine, surgery, ophthalmology, psychiatry, oncology, dentistry), emergency department, diagnostic imaging department, pathology department, blood bank, surgery department, ophthalmology department, operating department.	4,416.98	4,422.98
New West Building	Two stories Reinforced concrete structure	Obstetrics and gynaecology department, physiotherapy department, ENT (ear, nose and throat) department, internal medicine department, etc.	4,349.66	4,349.66
Attached facilities	Reinforced concrete structure	A sloping corridor, guardroom, electricity room, elevated water tank	469.75	433.75
Total			9,236.39	9,206.39

Source: Source for the plan is the report of the preparatory survey of the project, and that for the actual is the project completion report.

As shown in Table 2, output related to the procurement and installation of equipment was as planned apart from the number of adult beds being changed from 39 to 36, and that of Gatch beds[5] from 3 to 6. This change was made because it was agreed that an increase in the number of Gatch beds was necessary to care for patients who have difficulty getting up from a flat bed.

[4] The main changes were as follows: the location of the restroom building, the layout of the general outpatient reception, the location of various rooms in the operating theater, the shape of windows, the location of toilet in labor rooms in the obstetrics and gynecology department, and addition of the slope landing and the waiting room for the obstetrics and gynecology department.

[5] Medical beds that angles of head, waist and knees are adjustable.

Table 2 Main Outputs of the Project <Procurement and Installation of Equipment>

Departments/Usage	Name of the Equipment (plan and actual are the same)	Quantity	
		Plan	Actual
Internal medicine ward	ECG	3	3
Dental department	Dental unit	1	1
Emergency medical treatment	Ambulance (4WD)	1	1
Clinical tests	Blood coagulation meter	1	1
ENT and Ophthalmology departments	Surgical microscope (ENT) Surgical microscope (Ophthalmology)	1 1	1 1
Obstetrics and gynaecology and paediatrics departments	Incubators	2	2
	Infant warmers	6	6
Operation and emergency operation (including delivery)	Anaesthesia machines with ventilators	2	2
	Large autoclaves	2	2
	Ceiling-mounted shadow-less lumps	5	5
	Electrosurgical units	3	3
	Endoscope unit (for upper digestive tract/colonoscope)	1	1
	Operating tables	5	5
	Delivery tables	3	3
	Patient monitors	5	5
	Delivery monitor	1	1
Diagnostic imaging	Film developing machine	1	1
	Ultrasound machine	1	1
	Digital X-ray unit	1	1
Other wards, etc.	Adult beds	39	36
	Children's beds	16	16
	Gatch beds	3	6

Source: Source for the plan is the report of the preparatory survey of the project, and that for the actual is the project completion report.

Incubator and Infant Warmer
in the Pediatric Department

Clinical laboratory

Source of the photos: External Evaluator

In the capacity-building program, hospital staff were provided with guidance on the operation of facilities and equipment, on the maintenance and management of the medical equipment based on daily checklists, and on the procurement of consumables and replacement parts using an equipment

management ledger. This component was implemented in three stages. This was done according to the plan as well.

In light of the above, this project had outputs as planned.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost on the Japanese side was JPY 1,945 million planned and JPY 1,572 million actual. The project cost on the Myanmar side was JPY 11 million for both planned and actual. The total project cost was JPY 1,956 million planned and JPY 1,583 million actual, which was within the plan (81% of the plan). The actual cost was lower than planned as a result of the bids received for the contract.

3.2.2.2 Project Period

The project period was planned for 22 months, and the actual period was 31 months from June 2014 to December 2016. The actual exceeded the plan (141%).[6] The extension of the project period was due to the construction of the facility taking longer than planned. This was because securing the necessary personnel for the construction work, such as formwork carpenters and plasterers, was difficult due to the booming of the construction market caused by the rapid increase in public and private investment in infrastructure projects after the democratization of the country.

Although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[7] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

At the time of planning, it was expected that the project would improve the medical services of the hospital, and increases in (a) the number of outpatients, (b) the number of inpatients, (c) the number of deliveries, (d) the number of general anaesthesia operations, and (e) the number of cases referred by lower-level medical institutions, were set as quantitative effect indicators. Indicators (a) to (d) were expected to increase by 10%, and (e) was expected to increase by 35%.[8]

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[6] For calculation of the project period, the starting point was the date the detailed design started, and completion was the date the installation of equipment was completed, for both planned and actual.

[7] Sub-rating for Effectiveness is to be put with consideration of Impacts.

[8] Although the preparatory survey report of this project did not specify the reason for setting the target rate of

As shown in Table 3, among the quantitative effect indicators set at the time of planning, (a) the number of outpatients, (b) the number of inpatients, (c) the number of deliveries, and (d) the number of general anaesthesia operations were achieved far more than expected.

As shown in Figures 2 to 5, indicators (a) to (d) were increasing even before completion of the project. There were three main reasons for these increases. Firstly, the need for medical care at hospitals in the region had been increasing from the time the project was planned. The Senior Medical Superintendent of the hospital and Kayah State Health Director explained that the need increased because of the following reasons: in those days the government started providing medicine at the public hospital free of charge, road conditions in the project area were improved, and the local community increased their understanding of western medicine even though they had depended on traditional medicine in the past. Secondly, in response to this increased need, in 2015 the Ministry of Health and Sports of Myanmar upgraded the hospital from a 200-bed hospital to a 500-bed hospital and expanded its capacity by constructing paediatrics and orthopaedic buildings and increasing the number of medical doctors including specialists. Thirdly, the Technical Cooperation Project of JICA, "Health System Strengthening Project[9]" (hereinafter referred to as the "Technical Cooperation Project") was started in 2014 with the aim of strengthening the management capacity of the health planning of the Ministry of Health and Sports and the Kayah State; activities related to improving services to the hospital users and work efficiency were implemented. Figure 1 summarizes these inputs.

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increase as 10%, it seems that the following (i) negative reasons and (ii) positive reasons were considered. (i) At the time of planning, there was a shortage in the number of medical doctors of the hospital, and it was not known if the shortage would be filled. Therefore, the project did not anticipate the establishment of new clinical departments and was planned assuming that the number of beds at that time would be maintained in the new facilities. (ii) Militants in neighboring Karen State had become inactive and public security in the region had improved. Hence, the number of outpatients at the hospital, which decreased in 2011 and 2012, had tended to increase from 2013. It was anticipated that the number of inpatients would increase as a result.
It is unclear why only indicator (e), the number of cases referred by lower-level hospitals, was expected to increase at a higher rate.

[9] The Technical Cooperation Project was implemented for three years from November 2014 to October 2018. The capacity-building was implemented for the staff of the Ministry of Health and Sports and the staff of the Public Health and Medical Services Departments of Kayah State. Kayah State was selected as a target area because it has a relatively small population and small area, and it is possible to create a model for improving health and medical care services and strengthening administrative capacity in a short period of time. It was also selected because the synergetic effect with this project would be expected.

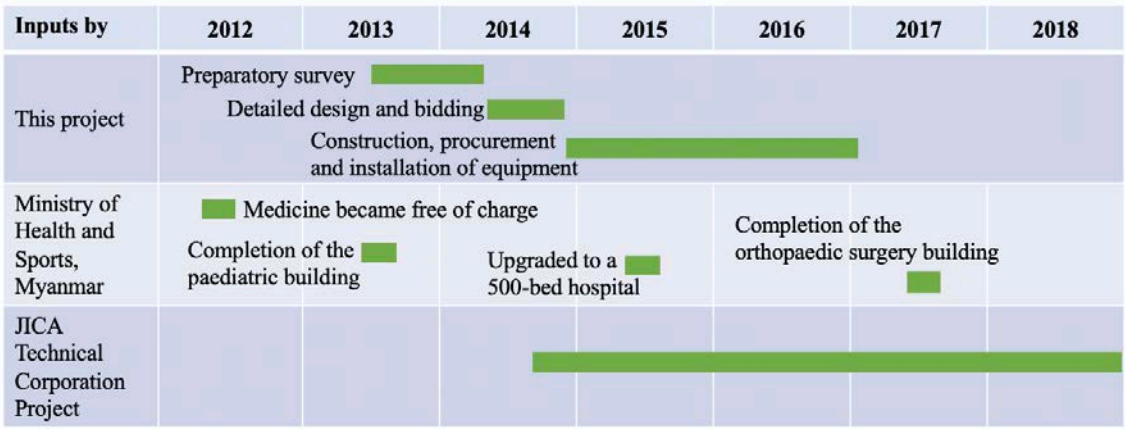


Figure 1 Inputs to the Hospital by this Project, Ministry of Health and Sports of Myanmar and the JICA Technical Cooperation Project

Source: Developed by the External Evaluator

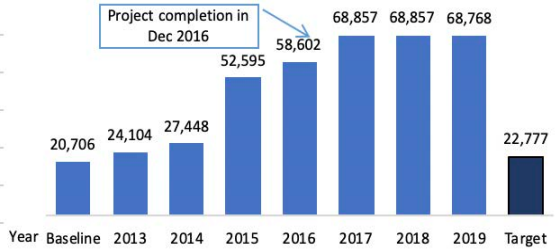
These indicators have been also increasing since the completion of the project. Figure 7 shows the number of operations in the operating theatre provided by the project; Figure 8 shows the number of new outpatients treated in the consultation rooms of the obstetrics and gynaecology, ophthalmology, dentistry, and ENT departments. These figures show that the numbers of users of these facilities were increasing year by year (Figure 8), and the utilization status of the facilities is positive. That of the equipment provided by the project is also positive (Table 4). Therefore, it can be assumed that this project has contributed to the increase in these indicators.

As shown in Figure 6, the level of achievement of indicator (e), the number of cases referred by lower-level medical institutions, was 82%, which was below the target. However, in Myanmar it is possible to visit a general hospital without a referral from a lower medical institution; most outpatients of the hospital visit without it.[10] Therefore, the relationship between the number of cases referred by lower-level medical institutions and the expansion of the functions of the hospital is not very strong, and the significance of this indicator in determining the effectiveness is limited.

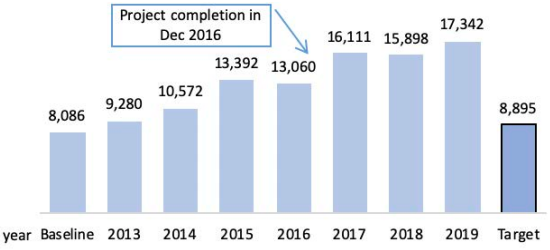
[10] For example, the number of referrals from lower-level medical institutions was 818 in 2019; this was only 2% of the number of new outpatients (38,299) in that year.

Table 3 Actual Figures and Level of Achievement of the Quantitative Effect Indicators

Indicators	Baseline (2010 - 2012)	Target in 2019 (3 years after completion)	Actual (2019)	Level of achievement (%)
(a) No. of outpatients	20,706	22,777	68,768	302%
(b) No. of inpatients	8,086	8,895	17,342	195%
(c) No. of deliveries	1,053	1,158	2,659	230%
(d) No. of general anaesthesia operations	566	623	931	149%
(e) No. of cases referred by the lower levels of medical institutions	744	1,000	818	82%

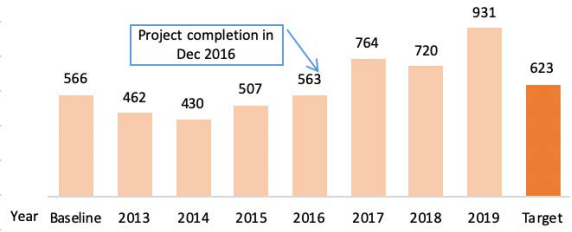


(a) Figure 2 Number of Outpatients

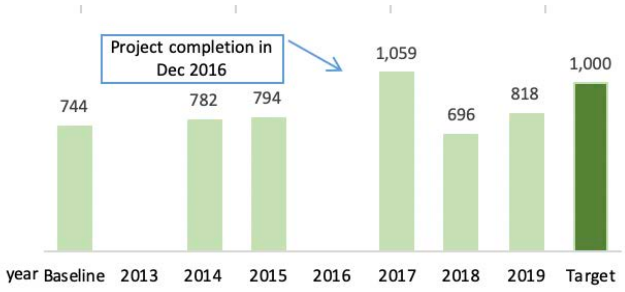


(b) Figure 3 Number of Inpatients

(c) Figure 4 Number of Deliveries



(d) Figure 5 Number of General Anaesthesia Operations



(e) Figure 6 Number of Cases Referred by Lower-Level Medical Institutions

(Data was not collected in 2013 and 2016)

Note: Baseline figures are the data recorded during the years of 2010 and 2012.
Source: Reply from the Hospital to the ex-post evaluation questionnaire

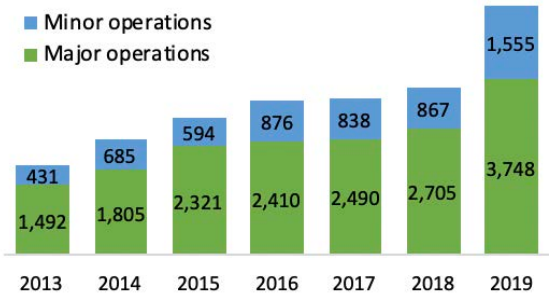


Figure 7 Number of Operations

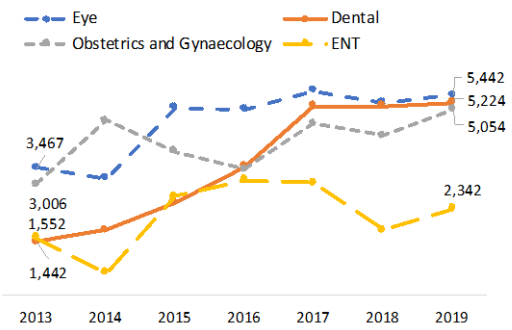


Figure 8 Number of New Outpatients by Treatment Departments

Note: Figure 8 shows the number of ENT patients decreased in 2018. This was due to the absence of a specialist doctor at that time.

Source: Reply from the hospital to the ex-post evaluation questionnaire

Table 4 Status of Usage of the Equipment

Departments	Equipment	Indicators	2014	2015	2016	2017	2018	2019
Surgery	Endoscope (upper digestive tract)	No. of equipment owned	-	-	1	1 (+1)	1	1
		No. of usage per year	-	-	-	72	233	303
Internal medicine	ECG	No. of equipment owned	-	-	3(+2)	3	3	3
		No. of tests per year	-	-	3,431	3,439	3,240	3,819
Diagnostic imaging room	Ultrasound machines	No. of equipment owned	-	-	-	- (+1)	-	4
		No. of diagnosis per year	2,253	2,910	3,417	3,674	3,749	4,116
	X-ray unit	No. of equipment owned	-	-	-	- (+1)	-	4
		Number of X-rays taken per year	3,676	8,799	8,080	8,535	9,950	10,763
Ophthalmology	Cataract surgery instrument set	No. of equipment owned	1	1	1	1 (+1)	1	1
		No. of operations per year	80	139	153	168	280	358
NICU	Incubators	No. of equipment owned	2	3	6 (+2)	6	7	6
		No. of patients using the equipment per year	42	90	78	31	72	39
	Infant warmers	No. of equipment owned	4	4	6 (+2)	6	11	11
		No. of patients using the equipment per year	172	177	260	229	148	258
	Phototherapy units	No. of equipment owned	5	6	10 (+3)	11	13	13
		No. of patients using the equipment per year	375	306	240	1,206	1,345	807

Notes:

- The amount of functioning equipment was included in the “No of equipment owned” (equipment that was out of order was not counted).
- Numbers in brackets indicate the amount of equipment procured by this project. The numbers are recorded in 2016 or in 2017 since the equipment was provided at the end of 2016.
- "-" indicates there was no record.

Source: Reply from the hospital to the ex-post evaluation questionnaire

3.3.1.2 Qualitative Effects (Other Effects)

At the time of planning, the project was expected to produce qualitative effects, such as improvement in the quality of medical services and in hygiene and medical environment of this hospital, further enhancement in patient satisfaction and in the motivation of medical staff, and increased placement of doctors. At the time of the ex-post evaluation, interviews were conducted with the senior Medical Superintendent, doctors and nurses of the hospital, and the following qualitative effects of the project were confirmed.

【Improvement of quality of medical services】

- In the past, beds were placed on the veranda and corridor because the ward was small. We do not have to do this anymore in the new building. The space between the beds in the ward has been increased. As a result, we are now able to carry out nursing care and emergency response without difficulty. (Obstetrics and Gynaecology Department)
- Because we have more equipment, treatment and examinations can be conducted without keeping patients waiting. (Paediatrics Department)
- The endoscope we had previously was frequently out of order, and we could not use it when it was needed. Now, we can use the equipment whenever needed because a new endoscope was provided by the project. Examination and treatment by the endoscope reduced the burden on patients, improved the accuracy of diagnosis, and led to early detection. (Surgery Department)
- Component blood transfusion became available as a result of the introduction of a centrifuge. (Blood Bank)
- Efficiency of testing was improved as a result of the introduction of the semi-automated biochemical analyser and blood coagulation monitor. (Clinical Laboratory)

【Improvement in hygiene and medical environment】

- The new consultation rooms and wards are well-ventilated, spacious, and well-lit.
- The wards and operating theatres are laid out in a way that allows the hospital to prevent and control hospital infections, to move patients in and out, and to provide nursing care.
- Previously, the clinical laboratory had a blood sampling room and a laboratory in the same room. They are separated in the new building, which facilitates strict hospital infection prevention.
- At the time of planning, the old buildings had deteriorated, and some parts of the concrete frame were exposed. It was dangerous to continue medical activities. This problem was completely solved.

【Improvement of patient satisfaction】

- Previously, the wards had many patients in large rooms. Now, these wards have smaller

rooms for up to six patients and private rooms. There are also curtains between the beds. Patients' privacy is protected, and their level of satisfaction has improved. Patients need to pay a fee for private rooms; however, they are very popular. Private rooms for obstetrics and gynaecology, internal medicine, and surgery departments are always full.

【Further enhancement of medical staff's motivation】

- We were working with even higher motivation than before, and it gives us pleasure to provide better nursing and medical services and contribute to the local community as a result of the wards being expanded and well-equipped by the project.

【Facilitation of doctors' placement】

- Senior specialists[11] were assigned to the departments without any senior specialists at the time of planning, including oncology, diagnosis imaging, ENT, ophthalmology and orthopaedics departments as well as clinical laboratory. Compared to the time of planning, the number of specialists has increased from 16 to 19, and that of general physicians has increased from 21 to 60. The number of doctors in total has increased from 37 to 79. This is because the project expanded the facilities, provided the necessary equipment, and developed a working environment suitable for specialists and doctors. In addition, the approved number of staff was increased as a result of the hospital being upgraded to a 500-bed hospital.

The external evaluator interviewed the users of the hospital and obtained the following opinions. There were no complaints (see the column below).

- The wards have more space and are less crowded than before.
- There are specialists and good equipment.
- Doctors and nurses are kind.
- The inpatients receive consultations and blood sampling tests on time and properly.
- Communication with lower-level hospital is smooth. There was no waiting time on admission because it was already informed.
- It is good that we can sit and wait in a specialized outpatient clinic.

[11] After obtaining the qualification as a specialist, he/she becomes a senior specialist by having 3-5 years of practical experience.

【User's Opinion】

Family member of an inpatient (at the internal medicine ward)

My father was admitted to the orthopaedic surgery department of this hospital due to a fracture, but he was transferred to the internal medicine department because his heart was weakened by the shock at the time of the accident. Information about the transfer was shared properly between these two departments; therefore, he was transferred smoothly. Medical services of the hospital are good. I had my father admitted to the old hospital before, but it was small and crowded at the time. The new wards are spacious and bright and very good.

Outpatient (at the waiting area of the outpatient department)

I live in Loikaw City and visit this hospital whenever I need a consultation. Before these buildings were constructed, we were using the old building, which was small and crowded. But now, they have more space and patient-friendly design. It is also convenient that, after registration, I can sit and wait until my turn for examination comes.

In the Technical Cooperation Project, a client satisfaction survey was conducted for users of the hospital in February 2018. This report referred to the results of this survey since it shows the users' evaluation of this hospital.

As shown in Figure 9, the majority of the respondents answered "good" or "very good", and almost no respondents answered "bad" to any of the questions in the survey. It shows that the users highly appreciated the hospital.

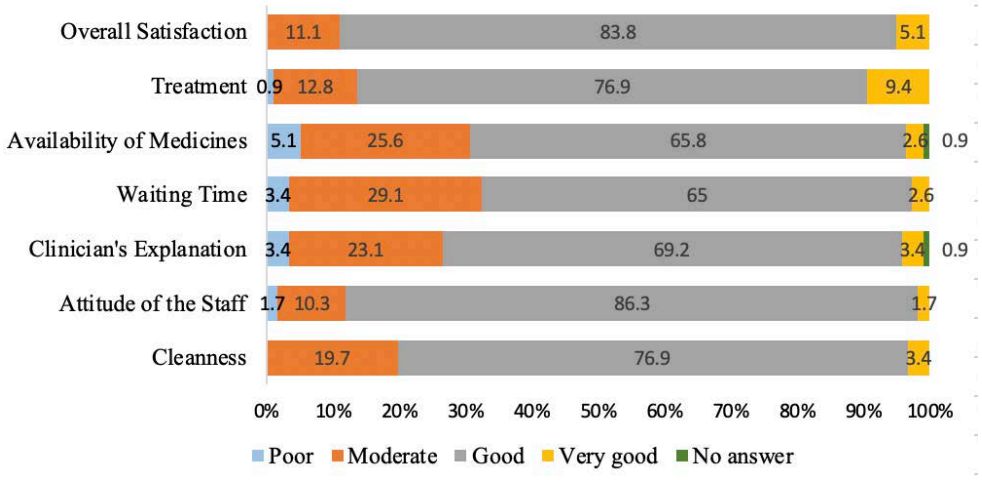


Figure 9 Client Satisfaction Survey (N=117)

Source: Illustrated by the External Evaluator based on the Satisfaction Survey conducted in the Health System Strengthening Project.

As mentioned above, the service of the hospital is improving, and its quality has not been declined due to rapid increase of patients. This is because the capacity of the hospital has been enhanced by the Ministry of Health and Sports increasing the number of staff including doctors and constructing new paediatric and orthopaedic buildings, in addition to the improvement in facilities and equipment implemented by the project. Activities conducted in the Technical Cooperation Project were continuously implemented. They include in-service training conducted at the hospital twice a month voluntarily (the hospital staff call this Continuous Nurses Education and Continuous Medical Education), prenatal and postpartum health education, hospital infection control, 5S activities[12] for improving the work environment, collection of feedback from users,[13] and dissemination of information and communication with the local community using their Facebook Page. Such activities are implemented continuously, contributing to the service improvement at the hospital.

Facebook Page of the Hospital

In September 2019, the hospital received the "Patient Safety Award" from the Ministry of Health and Sports. This showed that the efforts of the hospital to prevent and control hospital infections were highly appreciated.

【Patient Safety Award】

In 2019, the Ministry of Health and Sports reviewed the status of hospital infection prevention and control practices at public hospitals across the country. As a result, the hospital's strict infection prevention and control practices by ways of 5S and encouragement of hand washing were highly evaluated. The hospital was evaluated as the top out of the state and regional general hospitals in the country and received the first "Patient Safety Award".


Patient Safety Award Ceremony

[12] The acronym S for the Japanese words of *Seiri*, *Seiton*, *Seiketsu*, *Seiso* and *Shitsuke* (in English Sort, Set in order, Standardize, Shine and Sustain). The practice of 5S means activities that workplaces and organizations work on according to this system.

[13] The hospital has programs of getting feedback from users for improving the services. “Discharge parade” is one of them. They hold this program once a week, inviting patients who were discharged from the hospital on Fridays, along with their families, and listen to their experiences and requests for improvement.

3.3.2 Impacts

3.3.2.1 Intended Impacts

【Rationalization of the referral system】

At the time of planning, it was a problem that the hospital, a secondary hospital that was supposed to provide specialized medical services, was unable to fulfil its functions due to aging facilities and equipment. Therefore, as an impact of the project, it was expected that the hospital would restore its function as a secondary hospital and be able to accept patients referred from lower-level medical institutions.

At the time of the ex-post evaluation, in addition to discussions conducted with the Kayah State Health Department and the hospital, a visit was made to a lower-level hospital, Demoso Township Hospital. As a result, it was found that the state has a functioning referral system; referrals to the higher levels of medical institutions are conducted systematically. According to the director of the Township Hospital, Loikaw General Hospital is accepting referred patients promptly and responsibly, and there is good communication between the two hospitals.

In this way, the hospital properly accepts patients referred from lower-level hospitals, and there is no problem with regard to communication and systems for referring patients between different levels of hospitals. In this manner, the hospital has restored its function as a secondary hospital; it is evaluated that rationalization of the referral system, which was expected as an impact in the project, was realized.

【Opinion of a patient referred from the lower-level hospital】

(The interview was conducted with a woman who stayed with the patient at the obstetrics and gynaecology ward)

She gave birth to her third baby by caesarean section this morning. She had a prenatal consultation at a township hospital in Parson, about 5 hours' drive from this hospital. She was admitted here because a physician at the township hospital advised her to undergo a caesarean section operation here. She was glad that the admission took place smoothly because the township hospital contacted this hospital and made an appointment.

3.3.2.2 Other Positive and Negative Impacts

There were no negative impacts on the natural environment, and no resettlement or land acquisition by this project.

This project has achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

(1) Medical Service Department of the Ministry of Health and Sports

The Medical Services Department of the Ministry of Health and Sports is responsible for hospital care including his hospital. Under the Department, the Medical Care Division is responsible for the operation of public hospitals nationwide including this hospital, and the Procurement Division is responsible for the procurement and maintenance of medical equipment. The responsibilities and roles of the department and divisions are clear. In recent years, the Medical Service Department has been actively working on strengthening the maintenance system of medical equipment and developing human resources as follows (as of November 2019).

- Under the Procurement Division of the Department, a Biomedical Engineer Section was established for the maintenance of medical equipment, and 17 engineers were assigned.
- A diploma course training for medical engineers is conducted with support from the JICA Technical Cooperation Project, “The Project for Human Resource Development of Medical Engineering”.
- The course plans to train 75 medical engineers by April 2023. At the time of the ex-post evaluation, the first 18 graduates of the course were assigned as medical engineers at four tertiary hospitals in Yangon, Mandalay and Nay Pyi Taw. Graduates will be preferentially assigned to tertiary hospitals, which have a lot of medical equipment, and then to the state and regional general hospitals. Therefore, it will take some more years before a medical engineer will be assigned to this hospital.
- Until a medical engineer is assigned to this hospital, the Medical Services Department is planning to have the medical engineers assigned to Nay Pyi Taw, the nearest city to the hospital, visit surrounding state and provincial general hospitals including this hospital on a regular basis to provide advice on inspection and repair of medical equipment, in addition to conducting regular work at the assigned hospital.
- In order to conclude maintenance contracts with the local agencies of the manufacturers of MRI, CT, digital X-ray machines, etc., the Medical Services Department is making preparation for it such as analysis of cost efficiency and negotiation with them.

In this way, the Ministry of Health and Sports is working on strengthening the systems and organization for the maintenance of medical equipment, and there are no problems with regard to the institutional and organizational aspect of sustainability.

(2) Loikaw General Hospital

Figure 10 shows the organizational structure of the hospital. There were no major changes from the time of planning. Dermatology and forensic departments have been newly established after the planning time.

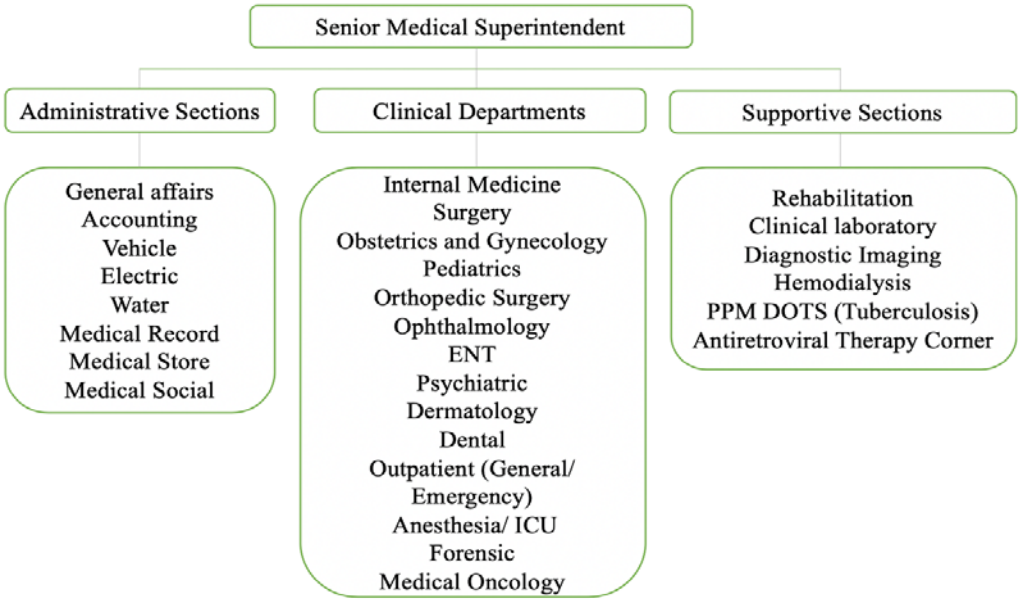


Figure 10 Organization Structure of the Hospital

Source: Reply from the hospital to the ex-post evaluation questionnaire

The hospital has 371 beds[14] and a total of 529 staff (as of August 2019). Since it was upgraded as a 500-bed hospital in 2015, the Ministry has been gradually enhancing the structure for the hospital by dispatching specialists, increasing the number of doctors, and constructing facilities. As Table 5 shows, comparing the time of planning and the ex-post evaluation, the number of doctors increased from 37 to 79, and among them, the number of specialists increased from 16 to 19. The fulfilment rate of the doctors is 37%, which is not adequate. The hospital is continuously requesting the assignment of more doctors. The fulfilment rate of nurses was already high, and their number was only increased by five. The total number of medical technicians, workers in charge of cleaning, washing, ironing, security guards, etc., and auxiliary staff such as general affairs and accounting, also doubled from 86 to 170. The overall fulfilment rate has dropped from 74% to 60% because the approved number of staff at the hospital was greatly increased as a result of it being upgraded to a 500-bed hospital; however, the actual number of staff is increasing only gradually.

[14] The actual number of beds is 371 although the hospital was upgraded to a 500-bed hospital in 2015. It is common in Myanmar that the number of approved beds does not match the actual number of beds. This is because the facilities and human resources are gradually strengthened after the upgrade, and the hospital will have the relevant number of beds after several years.

Table 5 Number of Staff and Fulfilment Rate at the time of Planning and Ex-post Evaluation

Item	At the Time of Planning			At the Time of Ex-post Evaluation		
	No. Approved	No. Appointed	Fulfilment Rate	No. Approved	No. Appointed	Fulfilment Rate
Doctors	104	37	36%	214	79	37%
Nurses	289	275	95%	416	280	67%
Other staff	139	86	62%	252	170	67%
Total	532	398	74%	882	529	60%

Source: Reply from the hospital to the ex-post evaluation questionnaire

The hospital has several operating rooms, including four at the central operating theatre on the second floor of the New East Building, one for the ophthalmic operations, and one for the obstetrics and gynaecology operations. Among these, the main operating rooms and the ophthalmic operating room were well utilized, but the obstetrics and gynaecology operating room was not used at the time of ex-post evaluation.

This is because the hospital currently has only two anaesthetists, who are stationed at the central operating theatre; the hospital cannot allocate an anaesthetist to the obstetrics and gynaecology operating room.[15] Therefore, obstetrics and gynaecology operations, like other surgical operations, are conducted at the central operating theater. It is desirable to use the operating room attached to the obstetrics and gynaecology ward in order to reduce the burden caused by transferring patients from the obstetrics and gynaecology ward or delivery room to the central operating theatre. The hospital has formally requested the Department of Medical Services of the Ministry of Health and Sports to increase the number of anaesthetists. The Health Director of Kayah State and the Department of Medical Services are fully aware of the need to increase the number of anaesthetists and would like to take immediate action.[16]

The Senior Medical Superintendent and her staff at the hospital have responsibility for the operation and maintenance of the facilities and equipment of the hospital. The Head nurses are responsible for the daily cleaning and maintenance of equipment in the respective departments. A civil engineer and electric engineer were assigned to the hospital and in charge of the maintenance of the medical equipment at the time of the capacity-building program of this project. At that time, the engineers regularly visited each department in the hospital and inspected the operation and cleaning status of the equipment at regular intervals according to the daily maintenance checklist introduced by the capacity-building program. However, since

[15] The approved number of anesthetists of the hospital is six, and the appointed number at the time of ex-post evaluation is two.

[16] In the country, earlier it was necessary to complete a doctoral course in order to become an anaesthetist. However, in recent years, in view of the necessity of increasing the number of anaesthetists, a system has been introduced whereby one can obtain the qualification of the anaesthetist by completing a master's program.

mid-2018 when these two engineers were transferred, this inspection has not been carried out. One of the staff members of the Medical Store Section was in charge of contacting agencies of manufacturers of equipment to request repairs; however, this post was also vacant at the time of the ex-post evaluation. At the time of the ex-post evaluation, the status of operation and maintenance of the medical equipment is reviewed at regular meetings conducted by the Senior Medical Superintendent and directors of the hospital. Requests for inspection and repairs to the agencies of manufacturers are made by the Senior Medical Superintendent or the doctors in the departments. In this way, inspections and repairs by agencies of the manufacturers are conducted.

The Department of Health of Kayah State and the hospital are aware of the need for a specialist in medical equipment and have requested the Ministry of Health and Sports to assign engineers to this hospital and other hospitals in the state. In response to this, the Medical Service Department would like to assign an engineer as soon as possible.

The maintenance of electricity and water-related facilities and equipment at the hospital is carried out by three technicians at the hospital. The drainpipes of air conditioners and parts of water pumps were replaced, and both were used without any problems. LED lamps, fluorescent lamps, wash faucets, and drains under the basin were replaced or repaired after they were worn out or damaged.

As mentioned above, although the number of staff, including doctors, has been increased at the hospital, there are issues such as a shortage of anaesthetists and the absence of staff specialized in the maintenance of medical equipment. However, there is a prospect of improvement in the future because there are mechanisms to make up for the shortage and absence, and Kayah State Health Department and the Department of Medical Service are planning to respond to these issues as soon as possible.

3.4.2 Technical Aspect of Operation and Maintenance

The hospital has requested the Medical Service Department to assign a specialist to the psychiatric department of the hospital because there is currently no specialist in the department. All other departments have specialists. There was no equipment or were no facilities that were not used or used extremely infrequently due to technical problems.

This hospital regularly conducts an in-hospital training program called the Continuous Nurses Education and Continuous Medical Education, to continuously improve and maintain the knowledge and skills of nurses and doctors. This activity was introduced in the Technical Cooperation Project and is continuing. Lecturers are assigned from among the hospital staff in turn and are sometimes invited from outside.

The Head nurses of the departments are responsible for daily inspection and maintenance of

medical equipment and for reporting any problems when they occur. However, the staff of this hospital, including the Head nurses, had no opportunity to learn about equipment maintenance after the Capacity Building Program of the project was implemented. This is a common issue for public hospitals in the country, and the Medical Service Department intends to improve the knowledge of staff in these hospitals about equipment maintenance by making arrangements for the staff in the Biomedical Engineering Section to visit and advise general hospitals in rural areas.

As described above, there are no technical problems relating to the usage of facilities and equipment, and the Medical Service Department has an intention to work on improving hospital staff's knowledge of maintenance of medical equipment in the future; therefore, there is no problem in terms of technical aspects of sustainability.

3.4.3 Financial Aspect of Operation and Maintenance

The budget and expenditure of the Medical Service Department of the Ministry of Health and Sports have been increasing year by year recently, both in terms of the total amount and the cost for repairs (building and equipment), in view of the necessity. The total expenditure in FY2017-18 (April 1, 2017 to March 30, 2018) was 309,536 million kyats (about JPY 24,678 million[17]). This was a 26% increase over the previous year. Material expenses, such as the purchase of medicines and equipment, and salaries of staff account for the majority of expenditure.

The annual budget and expenditure of the hospital has been increasing in recent years. Comparing the time of planning and the time of ex-post evaluation, it was increased about 3.7 times. It shows that the hospital has been strengthened as necessary as a 500-bed hospital in terms of finance.

The total expenditure for FY2018-19 (October 1, 2018 to September 30, 2019) was 1,956 million kyats (approximately JPY 136 million[18]). This was a 5% increase over the previous year. The items with a large proportion of expenditure were staff salaries and the purchase of medicines. These expenditures were made from the budget allocated by the Ministry of Health and Sports. Donations are frequently offered and used to fund hospital meals and the purchase of equipment, such as oxygen cylinders and wheelchairs. All revenues, such as from paid rooms, are paid to the Ministry of Health and Sports.

The Ministry of Health and Sports allocates a budget for the maintenance and repair of medical equipment and facilities at the beginning of the fiscal year. The hospital can disburse expenditure for the same by obtaining approval from the Senior Medical Superintendent of the

[17] Converted to JPY at exchange rates of the Central Bank of Myanmar on March 30, 2018.
[18] Converted to JPY at exchange rates of the Central Bank of Myanmar on September 30, 2019.

hospital if the amount is within budget.

The hospital applies for an additional budget from the Department of Medical Services if this budget becomes insufficient. According to the accountant at the hospital, in recent years the hospital applied for an additional budget for the maintenance and repair of medical equipment approximately twice a year, and all applications were approved.

It has been a problem that it takes several months until the application for an additional budget is approved. Furthermore, the repair of the equipment is suspended during this time. However, the situation is improving because the initial budget to the hospitals for the maintenance and repair of equipment was increased from FY2018-19 (October 1, 2018 to November 30, 2019) onwards.[19]

3.4.4 Status of Operation and Maintenance

Due to an increase in the number of patients, some facilities provided by this project became insufficient. Therefore, some clinical departments were relocated from the project buildings to other buildings.[20] There is no problem with the use of project equipment at the relocated places, or the use of facilities of clinical departments in the project buildings where more space has been made available due to the relocation.

Regarding the Dental department, the number of patients increased (see Figure 8), and the number of dentists increased from one to two after completion of the project. As a result, it became difficult to provide examination and treatment efficiently at the consultation room provided by the project, which has only one dental chair. Therefore, in 2017 the hospital renovated the existing building on the premises, procured and installed three dental chairs, and started dental examinations in the building. The dental chair and related equipment in the consultation room provided by the project were not moved to the building, and it was not utilized for a while. However, the room has been used for dental examinations and oral hygiene education for pregnant women since October 2019. As mentioned above, the operating room at the obstetrics and gynaecology department is not used because the hospital has only two anaesthetists.

The reporting and repairs are carried out according to the set procedure when any problem occurs with equipment. Although some problems were found in the surgical endoscope, the suction machine at the emergency department, and the autoclave at the operating theatre, necessary repairs and replacement of parts were conducted afterward. They were being used

[19] The initial budget for equipment maintenance for FY2017 was 600,000 kyats, and those for FY2018 and FY2019 were 10 million kyats, which was about 17 times.

[20] The rehabilitation room, the ENT department and the blood bank have been relocated to other buildings. The equipment provided by the project is used at the relocated sites. As a result of the relocation of these departments, the obstetrics and gynaecological department and clinical laboratories, which now have more space, are utilizing the space without any problems.

without interruption at the time of ex-post evaluation. At the time of the first field survey of the ex-post evaluation, there were ten items of equipment that were malfunctioning. The external evaluator pointed out the malfunctioning equipment since she was concerned that the equipment would continue to be used with the problems or that it would take several months for the related department of the hospital to report the problem to the Senior Medical Superintendent. However, the hospital received an inspection visit from an agency of medical equipment in December 2019 and made necessary arrangements for repair and replacements of parts.

Replacement of parts and repairs in case of wear or damage were conducted properly for the electricity and water-related facility. According to the staff in charge of the facility, they conduct replacement and repairs using locally available parts if the same design as the ones installed in the project is expensive and cannot be purchased with the hospital budget. In doing so, they take into account the original design and colours and try to keep the design concept as much as possible. The buildings and facilities were well cleaned and hygienic.

Well Organized Medicines

Regular Cleaning

The daily checklists brought in by the Capacity Building Program were completed regularly in some departments. However, some staff members did not fully understand the meaning of items on the checklists because they are written in English. They explained that they were completing the forms thinking that they must do what they were told although they do not fully understand the meaning of items in the forms. When the checklists are filled out by each department, the staff with expertise in equipment maintenance and management can visit each department to inspect and confirm the operation status of the equipment utilizing the checklists, which leads to the early detection and repair of malfunctioning equipment. When the external evaluator informed the Senior Medical Superintendent of the hospital about the importance of regular visits and inspections of the departments using the checklists for equipment maintenance, she expressed her intention to assign one of the technicians in charge of the facility maintenance for this work until a staff with the specialty could be allocated.

Sorting and organizing of medical equipment and medicines using the 5S technique

introduced by the Technical Cooperation Project, cleaning of the facility, and practice of good hygiene have been continuously carried on. These efforts are contributing to the sustainable operation and maintenance of the facilities and equipment provided by the project.

No major problems have been observed in the institutional/organizational, technical, financial aspects and current status of the operation and maintenance system. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to improve the medical services of the hospital in Kayah State by providing facilities and medical equipment.

Improving the quality of health and medical care services was a priority issue in Myanmar from the time of project planning until the time of the ex-post evaluation. There was a need to enhance specialized medical services of the state and regional hospitals in the country. Therefore, the project was consistent with the development policy and development needs of the country. This is highly relevant with Japan's ODA policy of supporting the development of health and medical services to improve the lives of the people. And therefore, the relevance of the project is high. Two buildings were constructed, and medical equipment was procured and installed as planned. Although the project cost was within the plan, the project period was longer than planned; therefore, the efficiency of the project is fair. The numbers of outpatients, in-patients, deliveries, and operations with general anaesthesia, which were the indicators of the effectiveness of the project, increased significantly and achieved their targets. The status of utilization of the facilities and equipment provided by the project is also positive. The expected effects, such as improvement of medical services, hygiene and medical environment; patient satisfaction at the hospital; and rationalization of the referral system, which was expected as an impact of the project, were achieved. The project has achieved its objectives; therefore, effectiveness and impact of the project are high. No problems have been observed in the institutional/organizational, technical and financial aspects of the operation and maintenance of the facilities provided by the project. Although there is a shortage of anaesthesiologists and specialized staff for the maintenance of medical equipment, these are being addressed as priority issues; there is a prospect for improvement. Therefore, the sustainability of the project effects is high.

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Sharing expertise of maintenance of medical equipment and conducting inspections by regular visits (recommendations to the Department of Medical Service, Ministry of Health and Sports)

The maintenance of medical equipment has become more important as the amount of equipment at this hospital has been increasing in recent years. This is because, in addition to the equipment provided by the project, the Ministry of Health and Sports has procured equipment at this hospital. At this hospital, the Head nurses of the clinical departments or staff in the Medical Store are taking responsibility for identifying problems with the medical equipment and reporting the same to the Senior Medical Superintendent. However, at the time of the ex-post evaluation, the external evaluator inspected each and every piece of equipment, and found that there were cases where equipment was continuously used even though it had problems, and it took several months for the staff of the clinical departments to report the problem to the Senior Medical Superintendent. The staff members were using equipment without noticing the failure or missed the appropriate timing for reporting of repairs. It is probably because those who are not specialized in the maintenance of equipment are undertaking inspections and reporting the problems. Until one of the medical engineers currently being trained by the Ministry of Health and Sports is assigned to the hospital, it is important for the Ministry and Department to assist the hospital with the effective use of the medical equipment over the long term by creating opportunities for hospital staff to learn specialized knowledge and by making arrangements for medical engineers to visit the hospital for the periodic inspection of equipment and to exchange their opinions. They can utilize resources from the JICA-assisted Medical Engineer Training Program for this purpose.

(2) Implementation of inspection visits using the maintenance checklist of medical equipment (Recommendation to this hospital)

As described in (1) above, at the time of the ex-post evaluation, there were cases where it took several months for clinical departments to report a problem occurring with medical equipment to the Senior Medical Superintendent. Some clinical departments are completing the checklists for the operation and cleaning status of equipment introduced by the Capacity Building Program of the project. However, they are not utilized effectively. When the checklists are filled out by each department, the staff with expertise in equipment maintenance and management can visit each department to inspect and confirm the operation status of the equipment utilizing the checklists, which leads to the early detection and repair of malfunctioning equipment.

The hospital has requested the Department of Medical Service to assign an engineer who has

knowledge of maintenance of the equipment. Until this assignment is realized, it is recommended to appoint an appropriate person from among existing staff members as the staff member in charge of equipment maintenance or to take up maintenance as one of the topics of the 5S initiatives, and carry out periodic inspection visits to the clinical departments using the checklist. At that time, the checklists, which are currently in English, can be translated into a local language to improve user friendliness, if necessary.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

(1) Synergy effect created by JICA's grant aid, technical cooperation projects, and institutional strengthening by the Executing Agency

At this hospital, the Technical Cooperation Project was implemented in parallel with the provision of facilities and equipment under this project. In addition, the Ministry of Health and Sports upgraded and institutionally strengthened the hospital by assigning specialists and increasing the number of doctors. The needs of the medical service in the region has increased since the project was planned, and the number of hospital users and surgical operations has increased drastically; however, as a result of the above-mentioned interventions, the quality of service provided by the hospital does not decline because the hospital has responded to the increasing needs adequately.

At the time of the ex-post evaluation, the utilization of facilities and equipment provided by the project is positive, and the consultation rooms and wards are kept clean. The level of satisfaction of hospital users is also high. This is the synergy effect created by the grant aid, the Technical Cooperation Project, and institutional strengthening by the Ministry of Health and Sports. In future, JICA can consider taking measures for increasing the effectiveness of a project by referring to the above-mentioned interventions as an example, such as implementing a grant aid and a technical cooperation project at the same time or encouraging the implementation of measures for institutional strengthening of the executing agency.

Republic of the Union of Myanmar

FY2019 Ex-Post Evaluation of Japanese Grant Aid Project

The Project for Rehabilitation of Baluchaung No.2 Hydropower Plant

External Evaluator: Hajime Sonoda, Global Group 21 Japan, Inc.

0. Summary

The Project for Rehabilitation of Baluchaung No.2 Hydropower Plant (hereinafter referred to as "the Project") was implemented in order to maintain the operating reliability and safety of the power plant for its long-term continuous operation through rehabilitation, thereby contributing to stable power supply in Republic of the Union of Myanmar (hereinafter referred to as "Myanmar"). At the time of ex-ante evaluation and the time of ex-post evaluation, both of rehabilitating the existing power stations and constructing new ones are particularly important issues in the electric power sector for Myanmar. Therefore, the Project is highly consistent with the national development policies and needs of Myanmar. Moreover, the Project was highly relevant to Japan's ODA policy at the time of planning which set its support for development of infrastructure and related systems for sustainable economic growth as one of the pillars of assistance. Therefore, the relevance of the Project is high. Although the project cost remains as planned, the project period was longer than planned and some outputs of the Project were added during its implementation. Therefore, the efficiency of the Project is moderate. After the termination of the rehabilitation work by the Project, the number of unplanned outages at Baluchaung No.2 Hydropower Plant has decreased, it has been performing the continuous operation for a long time, and the plant has recovered its maximum output. Annual power generation at the plant has increased by approximately 20% compared to the ex-rehabilitation period. The Project has highly achieved its objectives and made original impact in respect of the national power supply. Therefore, the effectiveness and impact of the Project are high. As no problems are observed with the institutional, technical and financial aspects of the operation and maintenance of the Project, the sustainability of the Project is high.

Considering all the above points, the Project is evaluated to be highly satisfactory.

1. Project Description

Project Location

Baluchaung No.2 Hydropower Plant

1.1 Background

In Myanmar, there has been power shortage since the late-1980's because the electricity demand has been higher than its supply. Its capacity of power generation was boosted by the development of the large-scale hydropower plants in the 2000's. However, the available power output was estimated to be less than 50% of the total installed capacity due to energy export to China, lack of fuel for thermal power plants and output decline by aging of the existing power plants, etc. Meanwhile, as the electricity demand was steadily increasing in line with its GDP growth, there was a critical shortage in the electricity supply for its demand. As a result, planned outages were carried out in Yangon, the largest demand city in the country. Responding to the high electricity demand that was expected to increase rapidly, promoting hydropower as a base load power supply was raised as an urgent issue in the power policy for resolving the planned outages. It was also set as a short-term objective to secure power generated by hydropower.

Baluchaung No.2 Hydropower Plant (total plant capacity 168 MW=28 MW x 6 units), which was constructed as the first hydropower plant in Myanmar, is situated on Baluchaung River in Lawpita, Kayah State, approximately 300 kilometers northeast from the capital Yangon. However, due to its long-term continuous operation, specifically over 52 years for Units No.1-3 and 38 years for Units No.4-6, it became serious problems that the plant equipment was heavily damaged and deteriorated.

In 1994, the rehabilitation work on the water turbine generators of Units No.1-3 was implemented under the Japanese's ODA Loan Project. However, the water turbine generators, main transformers, substation equipment, control equipment, etc. of Units No.4-6 have never

been full-scale rehabilitated. Under such circumstances, the Government of Myanmar requested the Government of Japan a grant aid project for the Rehabilitation of Baluchaung No.2 Hydropower Plant. The basic design study was carried out by JICA in 2001. As the result of the study, the rehabilitation works was planned in three stages and the first stage of rehabilitation work was carried out in 2002. However, the next stages of the rehabilitation works have been suspended due to domestic situation in Myanmar. After such interferences, JICA conducted the preparatory survey for the Project in 2012-2013. The survey reviewed the second and third stages of the rehabilitation plans by examining the necessary and reasonable rehabilitation works, ascertaining its effects and determining the appropriateness of implementation as a grant aid project. Based on the results of the survey, the Exchange of Notes and Grant Agreement for the Project was signed in March 2013.

1.2 Project Outline

Through the rehabilitation of Baluchaung No.2 Hydropower Plant, the Project aims to maintain operating reliability and safety in order to facilitate the long-term continuous operation of the plant, and thereby contribute to stable power supply in Myanmar.

Grant Limit / Actual Grant Amount	6,669 million yen / 6,669 million yen
Exchange of Notes Date/ Grant Agreement Date	March 2013 / March 2013
Executing Agency	Responsible ministry: Ministry of Electric Power (MOEP) (Currently the Ministry of Electricity and Energy) Implementing agency: Hydropower Generation Enterprise (HPGE) (Currently the Electric Power Generation Enterprise (EPGE))
Project Completion	May 2017
Target Area	Lawpita in Kayah State
Main Contractors	Hitachi Mitsubishi Hydro Corporation (Lot 1), Marubeni Corporation (Lot 2)
Main Consultant	Nippon Koei Co., Ltd. and Tokyo Electric Power Company Holdings Inc. (Consortium)

Basic Design / Preparatory Survey	June 2012-March 2013
Related Projects	The Project for Rehabilitation of Baluchaung No. 2 Hydropower Plant (2002)

2 Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda, Global Group 21 Japan, Inc.

2.2 Duration of the Evaluation Study

The ex-post evaluation study for the Project was conducted over the following period.

Duration of the Study: July 2019 - July 2020

Duration of the Field Survey: September 16 - October 9 in 2019, December 12 - December 19 in 2019

3 Results of the Evaluation (Overall Rating: A[1])

3.1 Relevance (Rating:③[2])

3.1.1 Consistency with the Development Plan of Myanmar

At the time of planning, Myanmar identified, as urgent issues, solving the regular power cuts as a short-term target and boosting the power generation as a medium-long term target on the power policy, requiring foreign aids to the power sector as its priorities. Both of rehabilitating the existing power stations and constructing new ones were highly prioritized among its short-term targets. According to *Myanmar Sustainable Development Plan 2018-2030* by the Ministry of Planning and Finance in 2018, it stated "prioritizing the rapid development of fundamental economic infrastructure, such as electricity generation, roads and ports, and establishing a data ID card system, a digital government strategy, and an e-government system" as one of the main policies. It also mentioned "Natural Resources & the Environment for Posterity of the Nation" as one of the goals, setting "providing affordable and reliable energy to populations and industries via an appropriate energy generation mix" as one of its strategies. Therefore, at the both times of ex-ante and ex-post evaluation, the Project was highly relevant to the development plan of Myanmar.

[1] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

[2] ③: High; ②: Fair; ①: Low

3.1.2 Consistency with the Development Needs of Myanmar

The stable hydropower was among the highest priority on the power policy as described in "1.1 Background" above at the time of planning. Although Baluchaung No.2 Hydropower Plant successfully continued to provide stable power supply through both rainy and dry seasons ever since the beginning of its operation in 1960, deteriorations and aging of the equipment have been recognized and the risk of serious accidents have increased due to this long-year operation. It was urgently necessary to recover the machinery function to the full via thorough rehabilitation of the deteriorated equipment for further stable operation.

At the time of ex-post evaluation, the Government of Myanmar approved *Power Development Plan (2014)* which was formulated with assistance of JICA. It was a development plan of the power sources and its distribution network up to 2030, setting importance to the hydropower as the base load power supply. Meanwhile, according to EPGE, the electricity demand in Myanmar is steadily increasing every year and is expected to reach 4,000MW by 2020. But the supply capacity has fallen short as the demand kept increasing. Power cuts also happen regularly in the major demand area such as Yangon and Mandalay. Baluchaung No.2 Hydropower Plant has operated as the base load power supply all year round, utilizing abundant water resources, and supplied approximately 6% of all Myanmar's power generation in 2018. It also works as a black-start operation for restarting the national power transmission grid in case of its fault. Therefore, necessity of the power plant is acknowledged at the time of ex-post evaluation.

In light of the above, the Project was consistent with the development needs of Myanmar at the both times of ex-ante and ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policies

In April 2012, the Government of Japan set one of the priority areas of assistant on "Development of infrastructure and related systems necessary for the sustainable economic development". JICA commenced a series of Technical Cooperation and Grant Aid accordingly, including the Project in the power sector in 2012. The first three (3) units (Units No.1-3) of the total six (6) power units of Baluchaung No.2 Hydropower Plant were commissioned under Japan's post-war reparations grant and were overhauled by its ODA Loan in 1987 after the 25 years operation period[3]. Further rehabilitation was planned in three stages by the Japanese Grant Aid in 2001 and the first stage of the rehabilitation work was

[3] Overhaul refers to the work of breaking machine products down to their parts, cleaning and reassembling them so that the machines are restored to the initial performance condition.

carried out. However, the next stages of this rehabilitation works have been suspended due to the Myanmar domestic circumstances. Therefore, the Project is consistent with the Government of Japan's ODA policies.

Based on the above, the Project has been highly relevant to Myanmar's development plan and development needs as well as Japan's ODA policies and, therefore, relevance of the Project is high.

3.2 Efficiency (Rating:②)

3.2.1 Project Outputs

In the Project, rehabilitation work was carried out on the generating equipment, substation equipment and penstock equipment at Baluchaung No.2 Hydropower Plant. The planned and actual outputs of the Project are as shown in Table 1.

Table 1 Planned and Actual Outputs

	Plan	Actual
Generating Equipment	Stator Coil of Generator, Control Panels for Generator, Inlet Valve, Turbine Runner, etc.	Generally, as planned. The additional outputs were the followings: − Repair of water turbine needle shaft packing and procurement of its packing of Unit No.3 − Procurement of CF brake for the windlass of ceiling crane
Substation Equipment	Main Transformers, House Transformers, 132kV Circuit Breakers, Emergency Power Supply, etc.	− Procurement of materials for rehabilitation of generator rotor field coil − Procurement of materials for generator rehabilitation − Procurement of tire coupling of Unit No.1, flow switch for generator air cooler of Unit No.6
Penstock Equipment	Penstock liner, etc.	− Procurement of water turbine lower nozzles, governor load control motors, flow control valves for oil lifter, and generator shaft bearings − Procurement of generator cubicles (Units 5, 6) − Procurement of status display unit, voltage detection circuit and measuring instruments for control room − Procurement of spare parts for main transformers and emergency power supply system
Consulting services	Detailed design, supervision, and training for improving maintenance capacity (soft component)	As planned.

Source: Information provided by JICA

The Project was carried out based on the basic design policies of the Detailed Design (D/D) by the Preparatory Survey (2013) such as “conducting the necessary and sufficient rehabilitation for preventing a serious fault and keeping the power plant in service consecutively”, “adopting technical specifications by taking into consideration of technical level of operation and maintenance staff whenever the restoration to the original condition is difficult”, and “designing the layout and installation method of the equipment to minimize impacts on the existing equipment”.

At the time of the Preparatory Survey, only the limited time was available for stopping and disassembling the equipment to examine the scope of rehabilitation since it would not allow to stop the machinery for a long time due to severe power shortages. During the implementation phase of replacing parts, there were sufficient time for breaking down and examining the equipment in detail. As a result, the necessity of some additional rehabilitation works, which were not found by the Preparatory Survey, were recognized. After multiple amendments of the contracts, some materials were procured as additional outputs, using surplus budgets of the Project (as described hereinbelow). Also, some important spare parts (transformers, etc.) for continuous generation were additionally procured. These changes were appropriate since those additional outputs were decided according to the project objective and planning policies. According to EPGE, the scope of the Project (including amendments in the implementation phase), quality of the equipment, the scope and methods of the soft component were appropriate. The activities shouldered by the Government of Myanmar, such as tax exemptions for imported equipment and materials, preparation of accommodations and offices for Japanese personal and assistance for them to obtain a visa were implemented in proper time. Concerning the project scope, the following points which affect effectiveness and sustainability of the Project can be raised;

- Before the implementation of the Project, the generators have experienced outages caused by blocked pipes of the generator cooling system (when warnings of temperature increase arose, unplanned outages for 1-2 hours were required for deep cleaning of the pipes). However, appropriate measures such as installation of auto strainer to treat cooling water containing impurities, which was recognized as the main reasons of this problems, were not included in the final requests by the Government of Myanmar, and they were not considered as the project scope. Therefore, even after the completion of the Project, unplanned outages are observed due to blocked pipes of the generator cooling system.

- The existing excitation systems (devices for adjusting voltage in each generator) were

so outdated that the necessary parts were no longer available in the market. Therefore, they were upgraded to new systems. On the other hand, since the power plant staff have a thorough knowledge of maintaining the governors (devices for adjusting frequency in each generator) from their over 50-year experiences from the beginning of operation, it was decided to maintain these original governors by making a few minor parts replaced. According to the examinations implemented by EPGE in 2018, however, it could not control a frequency enough in Units No.1-3. They think that this is due to insufficient output from the control motors of the governors. Incidentally, this sort of problem is not occurring in Units No.4-6, in which the control motors have larger output.

- After the completion of the Project, whenever they conduct a "black starting" at Unit No.4-6, a work of supplying the initial power required to start other power stations in case the whole transmission grid stopped, it became obvious at the transformer substations that its startup operation did not work out smoothly because the protector started working simultaneously. Although reasons for this phenomenon has not been found out, EPGE thinks it necessary to adjust the excitation system or readjust the protective equipment on the substations, as a new type excitation system has been combined with old type governor. In order to avoid these issues, EPGE developed its own methods that, whenever they conduct a black starting at the Baluchaung No.2 Hydropower Plant, they start operations at Unit No.4-6 by disconnecting once from the distribution network and then reconnect to it after generation has settled down.[4]

Out of the above issues, any measures for improving the quality of cooling water were not considered as this was not originally requested. In addition, there was a possibility to cope with those issue by proper maintenance such as systematically stopping the machinery for cleaning before warning would be given. Concerning the decision to maintain the old governors while upgrading the excitation systems, it might have had different conclusion if more detailed technical examinations were conducted. All the measures were examined according to the above policies from the viewpoints of keeping the project cost and its period within an appropriate scope. Therefore, it cannot be said that defining the project scope as described above was inappropriate.

[4] Having recorded this phenomenon when they put on a black starting in May 2018, EPGE discussed this matter with the consultant of the Project. However, it was necessary to collect additional records to clarify the cause. Meanwhile, when this phenomenon occurs during a black starting, it caused about 30-minute delay for power plants in the country to resume their operation, causing extended power interruption, and it is necessary to speed up the recovery process by adopting the new method described above. Therefore, no records of this phenomenon have been taken after May 2018.


Baluchaung No.2 Hydropower Plant: generating equipment (left), substation equipment (right)


Baluchaung No.2 Hydropower Plant: mechanical governor interior (left), control room (right)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was planned as 6,686 million yen (comprising 6,669 million yen on the Japanese side and 17 million yen on the Myanmar side). The cost of originally planned outputs on the Japanese side was reduced by approximately 7% as a result of competitive tender. As the additional outputs are included, however, the project cost reached 6,647 million yen (100% of the planned amount). The total project cost including the cost on the Myanmar side (actual cost 31 million yen) was 6,678 million yen (100% of the planned amount), which was almost as planned.

3.2.2.2 Project Period

The overall project period including the Detailed Design (D/D) and the tender procedure was planned as approximately 35 months from April 2013 to February 2016. The main

rehabilitation work was completed in February 2016, 35 months after signing of the consultant agreement in April 2014. Due to the extra times required for additional repair and procurement of the parts, the whole work was completed in May 2017. Thus, the actual project period was 50 months (143% compared to the plan).

The project cost was almost as planned meanwhile the project period exceeded the plan. Therefore, efficiency of the Project is moderate.

3.3 Effectiveness and Impacts[5] (Rating: ③)

3.3.1 Effectiveness

The expected outcomes by the Project is to maintain the operating reliability and safety of Baluchaung No.2 Hydropower Plant for a long-term continuous operation. For quantitative effects, the indicators are; 1) reduction of unplanned outages, and 2) increase of maximum output. With the focus on these quantitative indicators, the analysis of any changes in the operating performance of the power plant before and after the Project is shown in Table 2. Other effects are also analyzed as qualitative effects.

3.3.1.1 Quantitative Effects

In the Project, the rehabilitation works were carried out on the six generators, substation equipment and penstocks at Baluchaung No.2 Hydropower Plant between July 2014 and February 2016. Changes in the operating performance of the power plant before (2011~2013) and after (2017~2018) the Project are shown in Table 2.

[5] Impact is taken into consideration in rating of effectiveness.

Table 2 Changes in Indicators Before and After the Project

	Target at the time of planning	Before the Rehabilitation				After the Rehabilitation			Ratio
		2011	2012	2013	Average ①	2017	2018	Average ②	②/①
Unplanned outages (Note) (times/year per unit)	3.0	5.2	6.8	4.3	5.4	3.5	3.7	3.6	66%
Cooling system failures/troubles	None	4.7	6.8	4.2	5.1	3.3	3.0	3.2	62%
Other equipment failures/troubles	None	0.5	0.0	0.1	0.3	0.2	0.7	0.4	125%
Maximum output (power plant, MW)	None	157.5	157.0	152.0	155.5	166.9	167.8	167.4	121%
Generator on Unit No.1(MW)	28.0	24.0	22.0	22.0	22.7	28.0	27.0	27.5	108%
(Reference information) Annual Power Generation (GWh per power plant)	None	806	1,079	1,003	963	1,066	1,262	1,164	121%

Source: Compiled by the evaluator based on responses to a questionnaire by EPGE
Note: The number of unplanned outages in the table only shows outages caused by failures/troubles in generation equipment. Unplanned outages may also be caused by factors such as; troubles in transmission equipment outside of the power plant, shortage of water resources and so on. The objective of the Project was to reduce outages caused by failures/troubles in generator equipment. It should be noted that, the annual power generation (reference information) shows the contribution of Baluchaung No.2 Hydropower Plant to power supply in the entire country.

(1) Reduction of unplanned outages

As for unplanned outages (the number of the annual outage per one generator) caused by generator equipment failures or troubles, it was targeted by the Project to reduce the number to 3.0 times a year[6]. In reality, the number of unplanned outages was reduced from 5.4 times in the ex-rehabilitation to 3.6 times in the post-rehabilitation. Although the target of 3.0 times of annual outages was not achieved, the number of unplanned outages was reduced to approximately two-thirds. Therefore, the degree of achievement of the target is judged to be moderate[7].

Almost all of these unplanned outages were caused by failures or troubles in the cooling systems, mainly arising from cooling water leaks from deteriorated pipes and its blockages[8]. Unplanned outages caused by pipe leaks were prevented by replacing the

[6] According to the ex-ante evaluation of the Project, 15 unplanned outages per unit in 2011 was recognized as benchmark, and the target was set to reduce this figure to 3.0 outages per unit. However, as the definition (scope of its causes) of the unplanned outages as the aforementioned benchmark is not clear, the data newly obtained this time were considered as the benchmark. The consultant of the Project confirmed that the target on reducing unplanned outage was for any outrages caused by generation equipment. Based on the above, according to the performance of unplanned outages by failures or troubles in generation equipment which was shared by EPGE in the ex-post evaluation, the degree of target achievement was analyzed, assuming that 5.2 times/year (2011) as benchmark, 3.0 times/year as target and 3.6 timers/year as actual record in 2011.

[7] The degree of achievement is calculated as 73% based on the following calculation: "Realized reduction in the number of unplanned outages (5.2 times－3.6 times = 1.6 times)" ÷ "Planned reduction in number of unplanned outages (5.2 times – 3.0 times = 2.2 times)."

[8] Water from Baluchaung River which is the source of power generation and flows down from Movi Dam is used for cooling water. Any household trash by riverside residents into the water are increasingly causing pipe blockages.

cooling system in the Project. However, because no measures were taken to treat cooling water containing impurities recognized as the main cause of pipe blockages (see 3.2.1 Project Outputs), pipe blockages have continued to occur after the rehabilitation. Although pipe blockages are not serious enough to cause damage to generator equipment, the generator has to be stopped for one or two hours whenever it happens, giving an impact on power generation.

The number of unplanned outages caused by factors outside of the generator equipment slightly increased after the rehabilitation (0.3 times→0.4 times). In the first two years after the rehabilitation (2017-2018), the overall power plant experienced five outages, one of which was caused by an external factor (the damages by a snake on the transformer substation equipment), the others arose from problems out of the scope of the Project. Concerning the equipment which were rehabilitated by the Project, no failures or problems had arisen by the time of ex-post evaluation, and it is thought that more unplanned outages would have occurred if they were not rehabilitated. Therefore, this slight increase does not signify any failure in the rehabilitation conducted under the Project.

An unplanned outage was caused at the generator of Unit No.6 in 2018 due to a short circuit fault by a snake on the transformer substation equipment. The system successfully resumed operation in a short time (25 hours) by utilizing the emergency transformer procured by the Project. Without this emergency transformer, it would have needed to borrow one from another power plant or substation, resulting in a long-term outage.

In light of the above, the Project contributed to reducing unplanned outages and to operating continuously at Baluchaung No.2 Hydropower Plant[9].

(2) Maximum output

The maximum output of the generator on Unit No.1 at Baluchaung No.2 Hydropower Plant fell to 24MW in 2011 due to deterioration. The Project aimed to restore its rated maximum output up to 28MW. Although the maximum output of the generator on Unit No.1 fell to 22MW in 2013, this was restored after the Project up to 28MW as planned (it reached to 28MW in 2015 immediately after the rehabilitation work). The maximum output was only 27MW in 2018 but there has not been any particular trouble at Unit No.1 since the rehabilitation. Therefore, this slight drop should not have been related to the generator issues.

[9] Concerning the time length of unplanned outages (total time per unit/per year), it was impossible to collect chronological data according to causes in power plant equipment, in transmission equipment outside of the power plant, and other causes. But there was a major overall reduction from 141.6 hours in the ex-rehabilitation to 34.5 hours in the post- rehabilitation (Down to 24% compared to the ex-rehabilitation).

Moreover, as a result of the rehabilitation, maximum output of the overall power plant increased by approximately 12MW, 21% higher than before the rehabilitation, and it reached the highest record 167.8MW (99.9% of the rated maximum output 168MW) in 2018.

In light of the above, it can be determined as a result of the Project that the maximum output of Baluchaung No.2 Hydropower Plant was restored as planned. This shows a high degree in the achievement of the project purpose.

(3) Power Generation (Reference Information)

The annual power generation at Baluchaung No.2 Hydropower Plant increased from 963GWh of the ex-rehabilitation up to 1,164GWh of the post-rehabilitation (121% of the before-rehabilitation level). The annual power generation in 2018 reached to 1,260GWh, which is 86% of the plant's maximum capacity of 1,472GWh (168MW x 6 units x 24 hours x 365 days), indicating that the plant operated at almost full capacity. It can be considered that the reduction of unplanned outages, namely an increase of operating hours, as well as the increase of maximum output by the Project have contributed to the above improvement[10].

3.3.1.2 Qualitative Effects

The soft component of the Project was carried out for the power plant staff, by providing trainings and manual on operation and maintenance of electro-mechanical equipment and hydrostatic penstock pipes. This resulted in implementing the manual-based operation and maintenance (preventive maintenance) and keeping its operation and maintenance records. At the time of ex-post evaluation, it was confirmed that these activities are still continuing.

According to EPGE, the reliability and safety levels of the facilities/equipment have generally improved by the Project (no accidents reported after the Project was completed) and this has helped in releasing the psychological stress felt by the power plant staff. They mentioned that their work has become less stressful than those previous days when they usually had concern on how soon the machines would be broken down.

In light of the above, it can be summarized that, after the rehabilitation by the Project, longer continuous operation has been achieved at Baluchaung No.2 Hydropower Plant with less unplanned outages. In addition, power generation has increased by 20% compared to the ex-rehabilitation by recovering maximum output. Also considering a high degree in the achievement of project purpose with regard to unplanned outages and maximum output, the

[10] The annual operating time per generator at the power plant increased from 7,630 hours in the ex-rehabilitation to 8,250 hours in the post-rehabilitation (Up 108% of the ex-rehabilitation).

effectiveness of the Project is high.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Contribution to the national power supply

Based on the EPGE data, the Myanmar's maximum output doubled from 1,588MW in 2011 to 3,189MW in 2017, while it is predicted to reach 4,000MW in 2020. The power generation also doubled from 10,312GWh in 2011 to 20,141GWh in 2017. Power shortage occurs by high electricity demand for air conditioners in summer from March to May and planned outages are set in Yangon and other demand area. While, since the 2000s, many hydropower plants have been constructed by the Chinese funds and commenced its operation in the northern part of the country. However, its power generation is constrained during a dry season from March to May due to reduced water flow there.

(Unit: GWh)

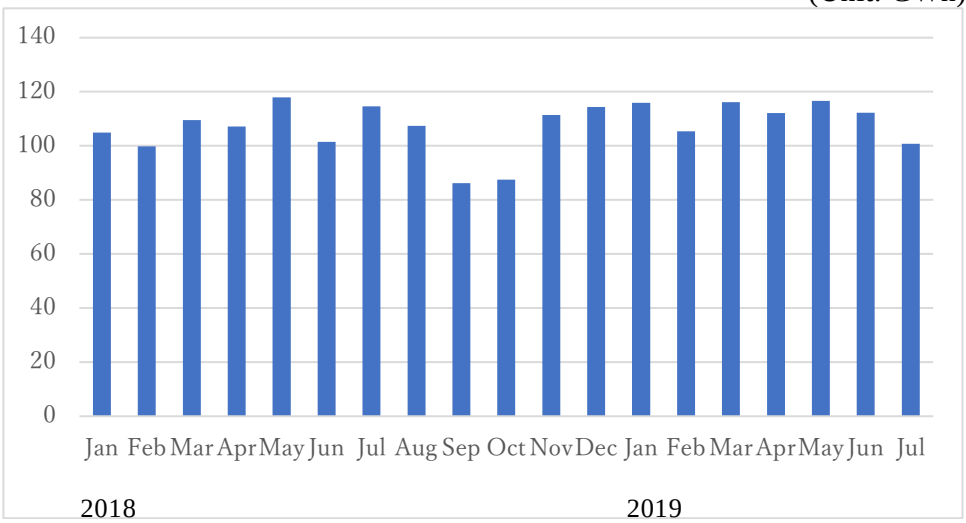


Figure 1 Amount of Energy Generated at Baluchaung No.2 Hydropower Plant

Source: Materials provided by EPGE

Baluchaung No.2 Hydropower Plant accounts for 5.2% of the Myanmar's electric power (MW) and 5.3% of its power generation (GWh) in 2017. Unlike hydropower plants in the northern part of the country, this plant generates power throughout the year including a dry season by utilizing abundant water resources from Moevi Dam (see Figure 1). The Project's direct contribution to the national power supply is regarded as increasing the maximum output up to approximately 12 MW which is 0.4% of the nationwide demand

in 2017 and increasing the power generation up to 202 GWh which is 0.1% of the nationwide demand in 2017. It can be determined that the anticipation for the Project in contributing to the national power supply has been realized, recognizing the full utilization of the plant.

(2) Contribution to black starting

Baluchaung No.2 Hydropower Plant has the duty of a “black starting”, a work of supplying the initial power required to start other power stations in case the whole transmission grid stopped. In that case, the stable frequency by individual power plants (generation unit) is required. As a result of the Project, the frequency of each generator became more stable, especially in Units No.4-6, and the plant can conduct a black starting more smoothly than before. On the other hand, because of the phenomenon that the protector trips at the transformer substations, an irregular operation is currently required such as disconnecting once from the transmission grid whenever they conduct a black starting (see 3.2.1 Outputs).

(3) Contribution to Baluchaung No.3 Hydropower Plant

Water from Baluchaung No.2 Hydropower Plant is utilized to generate further power at the Baluchaung No.3 Hydropower Plant (52MW) downstream. The fact that the Project has realized longer continuous operation at Baluchaung No.2 Hydropower Plant is considered to have contributed to the utilization of Baluchaung No.3 Hydropower Plant as well. However, EPGE has not developed any guidelines nor methods for the linked operation of Baluchaung No.1, No. 2, and No. 3 Hydropower Plants which generate electricity by using the same water source. Additionally, there is no practical operation plan based on the water resource conditions. These remain as issues for future analysis.

(4) Ripple Effects on Technical Aspects

The staff who worked for many years at Baluchaung No.2 Hydropower Plant and obtained experience through the Project have been promoted to senior positions at other hydropower plants. Moreover, EPGE has shared the manual and formats (maintenance inspection forms and repair log forms) prepared by the Project with other hydropower plants.

3.3.2.2 Other Positive and Negative Impacts

At the time of planning, no major environmental impacts of the Project were anticipated. The transformer insulating oil (PCB waste) and asbestos waste taken out by the Project has

been sealed and placed in storage as planned, so, there are no major environmental impacts. No other environmental impacts have been confirmed.

In light of the above, the Project has mostly achieved its objectives. Therefore, the effectiveness/impacts of the Project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspects of Operation and Maintenance

Baluchaung No.2 Hydropower Plant is under jurisdiction of EPGE and its organizational structure is as shown in Figure 2. Its organizational structure and job descriptions are well established based on many years of their operating experience and there are no particular problems in this regard. The Government of Myanmar currently restricts new hiring in all the government agencies based on its policy of reducing the number of civil servants by a third.

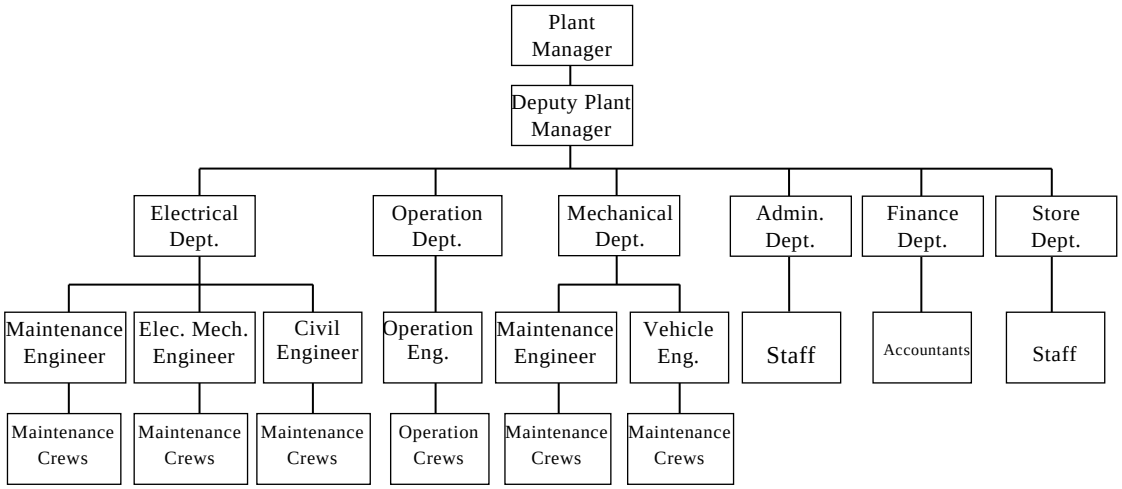


Figure 2 Organization Chart of Baluchaung No.2 Hydropower Plant

Source: Materials provided by EPGE

The staff number at Baluchaung No.2 Hydropower Plant in 2012 was 159 out of the regular staff number of 165. Based on the above policy, however, they laid off some staff while keeping experienced ones. The staff number at the time of ex-post evaluation was 114. They hired contract workers for non-skilled job rather than keeping full-time employees. According to the Plant, although the current workforce is not entirely adequate, it is enough for daily operation without any issues. However, in cases when experienced senior operators are absent for some reason, or when a major problem occurs, extra assistance is in need. Baluchaung No. 1 and No. 3 Hydropower Plants are located close to Baluchaung No.2

Hydropower Plant, so that they help each other in emergencies. Moreover, as institutional approach to such issues, the EPGE headquarters selects and dispatches its experienced staff with specific knowledge and skills to other plants whenever issues arise there.

In light of the above, there are no major issues regarding the institutional/organizational aspects of the project operation and maintenance.

3.4.2 Technical Aspects of Operation and Maintenance

As the average years of work experience of the operation and maintenance staff is about 20 years at Baluchaung No.2 Hydropower Plant, they gained a lot of knowledge and experience concerning operation and maintenance of the Plant. Out of the 55 operation and maintenance staff, three members have 30 years or more continuous experiences, 27 have between 20-29 years experiences, 18 have between 10-19 years experiences, and seven have less than 10 years experiences.

The manual and formats prepared by the Project's soft component are all being used. According to the participants in the staff trainings, the lectures and practical trainings of the soft component were the places to develop comprehensive knowledge of hydropower plant operation and maintenance. Almost all the training participants have remained in their current jobs, while two members have been transferred to other plants for a higher position.

Each power plant submits its spare parts list to the EPGE headquarters every month. It appears that the spare parts stock including those procured in the Project are well managed. According to Baluchaung No.2 Hydropower Plant, there are adequate quantity of the spare parts for maintaining power generation except for a few important ones. They applied to the EPSG headquarters for those parts[11]. In case the Plant is out of the spare parts stock, they can obtain from another plants or transmission and distribution companies (Department of Power Transmission and System Control) through the EPGE headquarters, although it requires some time. If genuine parts cannot be obtained, they are possibly manufactured in Myanmar. Manufacture information such as equipment drawings and user manuals are appropriately stored.

In light of the above, there are no major issues regarding the technical aspects of operation and maintenance.

[11] Every year, each power plant submits a necessary spare parts list and the reasons for their necessity to the EPGE headquarters. The headquarters conducts technical review of the contents and applies for a budget to the Ministry of Finance. The Ministry of Finance approves within the available budgets, however, according to EPGE, some items were not approved in 2017 and 2018. Since the governmental policy for 2019 is to give priority to budget allocations for infrastructure, it is anticipated that almost all the budget requests will be approved for this year.

3.4.3 Financial Aspects of Operation and Maintenance

According to EPGE, the income/expenditure balance of Baluchaung No.2 Hydropower Plant is as follows. The Plant's balance is in the black and the budget for continuous operation is secured.

Table 3 Baluchaung No.2 Hydropower Plant Income and Expenditure Balance

(Unit: million MMK)

	FY2016	FY2017	FY2018 first half
Income from electricity	45,037	59,267	35,137
Other income	2,280	2,502	29
Total Income	47,318	61,770	35,166
Salary	471	453	251
Maintenance	158	91	33
Consumables	57	54	31
Others (including depreciation costs)	3,181	3,445	1,757
Tax	2,147	2,825	1,675
Total Expenditure	6,015	6,867	3,746
Balance	41,302	54,902	31,420

Source: Information provided by EPGE

Previously, the electricity charges in Myanmar have been set at the lowest level even among the ASEAN nations, and the Government has borne the large cost loss margin. The transmission and distribution companies had been maintaining profitability with the wholesale prices of electric power sold by EPGE which had been kept low. However, EPGE had been in red due to this arrangement, and the government subsidies for deficit covering were provided only for EPGE. In July 2019, Ministry of Electricity and Energy (MOEE) revised the electricity charges substantially for the first time in five years, and simultaneously they aimed for a financial stability of EPGE by doubling its wholesale electricity prices. According to MOEE, the income/expenditure balance of EPGE is expected to show a surplus from 2020 onwards.

In light of the above, there are no major issues regarding the financial aspects of project operation and maintenance.

3.4.4 Operation and Maintenance Status

According to onsite inspection at the time of ex-post evaluation, there have cleaned in the Plant and the facilities are operated well functionally. After the damage by a snake in the substation, some protection plates have been installed to prevent further such infiltrations. The spare parts procured by the Project are appropriately stored in the warehouse.

As instructed in the soft component, all the operation and maintenance logs are recorded and any data has been computerized in the PCs. Since the previous data can be immediately retrieved on the computers, they can respond to any enquiries and submit necessary data to the EPGE headquarters whenever problems arise. However, in order to detect operational abnormalities, no time series analysis is made utilizing the data, while, in the same manner as before, interpretation of the figure is made simply based on past experiences. As also instructed in the soft component, the scheduled preventive maintenance (routine inspection and detailed examination) was successfully introduced. Daily operating records have been taken. Preventive maintenance of generators is carried out at weekends when the power demand is relatively low, stopping one generator for about five hours every week and another generator in the next weekend. According to the records, weekly maintenance has been certainly carried out. There were some cases where operational abnormality was detected through the routine inspection based on the manual and detailed inspections and repairs were conducted[12].

In light of the above, there are no major issues regarding operation and maintenance in the Project. It should be also noted that, although not directly included in the scope of the Project, as stated in 3.2.1 Outputs, it is assumed that the poor quality of cooling water and partial rehabilitation of the governor have an impact on operation of Baluchaung No.2 Hydropower Plant.

To sum up, no major problems have been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore, sustainability of the Project effects is high.

4 Conclusion, Recommendations and Lessons Learned

4.1 Conclusion

The Project was implemented in order to maintain the operating reliability and safety of

[12] In August 2018, water leakages were found in a penstock by inspection conducted according to the manual. This was repaired by stopping power generation for a while.

the power plant for its long-term continuous operation through rehabilitation, thereby contributing to stable power supply in Myanmar. At the time of ex-ante evaluation and the time of ex-post evaluation, both of rehabilitating the existing power stations and constructing new ones are particularly important issues in the electric power sector for Myanmar. Therefore, the Project is highly consistent with the national development policies and needs of Myanmar. Moreover, the Project was highly relevant to Japan's ODA policy at the time of planning which set its support for development of infrastructure and related systems for sustainable economic growth as one of the pillars of assistance. Therefore, the relevance of the Project is high. Although the project cost remains as planned, the project period was longer than planned and some outputs of the Project were added during its implementation. Therefore, the efficiency of the Project is moderate. After the termination of the rehabilitation work by the Project, the number of unplanned outages at Baluchaung No.2 Hydropower Plant has decreased, it has been performing the continuous operation for a long time, and the plant has recovered its maximum output. Annual power generation at the plant has increased by approximately 20% compared to the ex-rehabilitation period. The Project has highly achieved its objectives and made original impact in respect of the national power supply. Therefore, the effectiveness and impact of the Project are high. As no problems are observed with the institutional, technical and financial aspects of the operation and maintenance of the Project, the sustainability of the Project is high.

Considering all the above points, the Project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency (EPGE)

It is recommended to EPGE to examine possible measures to improve the water quality that causes clogging of the air cooler (installation of an auto strainer, etc.), and if it is found feasible, carry out these measures promptly.

4.2.2 Recommendations to JICA

JICA should encourage EPGE to take action on the above recommendation concurrently and monitor the status of its implementation.

4.3 Lessons Learned

Reserving additional fund and extra implementation period for rehabilitation projects

In the Project, although the scope of rehabilitation work was set by the Preparatory

Survey, however, since it was not possible to suspend operation of generators for long at this time, it was not possible to ascertain the need for rehabilitation in detail. After the commencement of the Project, the needs for additional repair work became clear in a process of breaking down the facilities, which were added to the project scope. Procurement for the additional scope was possible by utilizing surplus funds, since the procurement cost for the original scope was lower than the planned cost as a result of competitive tender. The project period was longer than the plans, therefore efficiency of the Project is judged to be fair.

As for any rehabilitation projects for electro-mechanical equipment such as power plant, in general, it is difficult to identify in advance the scope of all the necessary repair works for the equipment being currently in operation. Therefore, it is a reasonable argument that additional rehabilitation works to be added to the project scope at its implementation phases. Considering the above, in order to achieve the project purpose by appropriate rehabilitation, in accordance with the extent to which concrete needs for rehabilitation could have been confirmed at the time of planning, it is necessary to examine the necessity of additional budgets and extra implementation periods to be included in the plan.

Republic of the Union of Myanmar

FY2019 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Urgent Improvement of Water Supply System for Yangon City"

External Evaluator: Tomoko Tamura, Kaihatsu Management Consulting, Inc.

0. Summary

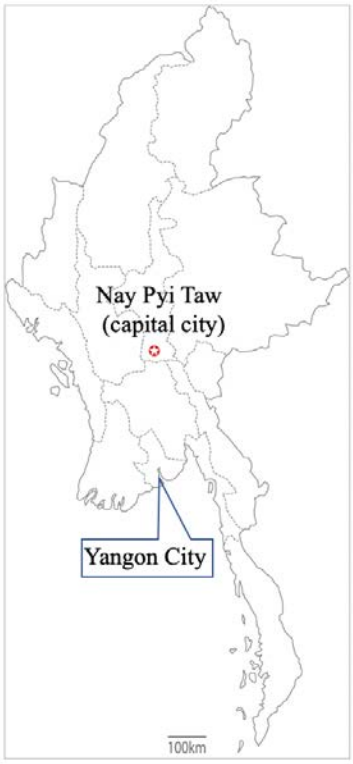
This project supported the improvement of water supply services in Yangon City by upgrading facilities that needed urgent rehabilitation.

From the time of project planning to the ex-post evaluation, improvement of water supply and sanitary conditions was a priority issue for the country, and there was a high need for improvement of water supply services in Yangon City. It has been recognized that the project was consistent with the development policy and needs of the country and also consistent with Japan's ODA policy of providing support to improve the lives of the citizens of Myanmar. Consequently, the relevance of the project is considered to be high. All planned facility construction was conducted, and the project cost did not exceed the budget. Since the project period was longer than expected, the efficiency of the project is considered to be fair. There were three components in the project. In the first component, (a) "Renewal of the Transmission and Distribution Pumps and Construction of a Pump House at the Nyaunghnapin First Phase Water Treatment Plant", the defective pumps that were not properly functioning were replaced. At the time of the ex-post evaluation, the renewed pumps were almost fully operational, with an average daily operating time of 22.9 hours. In the second component, (b) "Renewal of the Distribution Main Pipeline at the Kaba Aye Pagoda Road[1]", the aging distribution main pipeline was renewed. Since the completion of the project, traffic has not been interrupted due to the pipeline bursting or for its repair, and the expected outcome was achieved. In the third component, (c) "Renewal of the Distribution Network in the Pilot Area in Yankin Township", the aging distribution network was updated in the area. This solved the problem of frequent water leakage and reduced the rate of water leakage to 8% or less as planned. Improvement in the water supply service, including increased hours of water supply, resolution of the problem of water cuts, increased water pressure and quantity, improvement of the living environment, including reduction in the cost of electricity and working hours of the water pumps, and an improvement in hygienic behavior, were realized. Therefore, effectiveness and impact of the project are high. No major problem has been observed in the policy system, the structure, technical/financial aspects or in the current status concerning the operation and maintenance of facilities developed in the project. Further, some malfunctioning parts and attached facilities are expected to be repaired or improved. It is observed that sustainability of the project effects is high.

Considering these observations mentioned above, the project is evaluated to be highly satisfactory.

[1] This distribution main pipeline was described as "Distribution pipeline to Mayangon Township" in the preparatory survey report of the project. However, it is described as "Distribution Main at the Kaba Aye Pagoda Road" in this report according to the location of the pipeline.

1. Project Description



Project Location

Transmission and distribution pump at the Nyaunghnapin First Phase Water Treatment Plant

Water pressure and quantity were improved at this primary school in Yankin Township

1.1 Background

The water supply system of Yangon City served approximately 42% of the population of 5.1 million at the time of project planning in 2013. Water demand in the city had risen sharply with population growth, and the importance of the water supply service was increasing. However, the infrastructure of the water supply service had not been improved or expanded in a timely manner, because public investment in infrastructure and international support had been restricted, and there were limited choices of equipment suppliers for updating the facility due to the long-term economic sanctions imposed under the military administration. As a result, problems had arisen, such as water cuts, low water pressure, limited hours of supply and water leakage, because the facilities were aging or out of order.

The Ministry of Economy, Trade and Industry of Japan conducted the “Study on the Improvement of Water Supply and Waste Water Treatment in Yangon, the Republic of the Union of Myanmar” in 2011 in order to study interventions for such problems. The study identified five water facilities that needed urgent renewal, including the renewal of water transmission and distribution pumps at Nyaunghnapin Water Treatment Plant and the renewal of aging pipes in Yankin Township. Following the result of the study, Government of Myanmar requested cooperation for the urgent development of water supply facilities. This project was implemented in response to this request.

1.2 Project Outline

The objective of the project is to improve water supply services of Yangon City corresponding to the increasing demand for water by rehabilitating the facilities in need of urgent improvement, thereby contributing to an improved living environment for the local community.

Grant Limit Actual Grant Amount	1,900 million yen/1,851 million yen
Exchange of Notes Date /Grant Agreement Date	May 2013/ September 2013
Executing Agency	Water Resource & Water Supply Authority, Yangon City Development Committee (YCDC). The Authority was called "Engineering Department (Water & Sanitation)" at the time of project implementation
Project Completion	May 2016
Target Area	Yangon city
Main Contractors	Torishima Pump Mfg. Co., Ltd. and TODA Corporation
Main Consultant	TEC International Co., Ltd.
Preparatory Survey	February 2013-September 2013
Related Projects	・Study on the Improvement of Water Supply and Waste Water Treatment in Yangon City, the Republic of the Union of Myanmar (2011), Ministry of Economy, Trade and Industry ・Preparation Survey on the Project for the Improvement of Water Supply, Sewerage and Drainage System in Yangon City in the Republic of the Union of Myanmar (2012-2014) ・The Project for Improvement of Water Supply Management of YCDC (From 2015 onwards) ・Dispatch of JICA experts – Advisor on Water Supply Management in Yangon City (April 2012-April 2015) – Advisor on Water Supply and Sanitation Improvement in Yangon City (August 2015-August 2017) – Advisor on Water Supply and Water Supply Administration in Yangon City (December 2018-December 2020) ・Greater Yangon Water Supply Improvement Project (Phase I) (From 2014 onwards) ・Greater Yangon Water Supply Improvement Project (Phase II Stage 1) (From 2017 onwards)

2. Outline of the Evaluation Study

2.1 External Evaluator

Tomoko Tamura, Kaihatsu Management Consulting, Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: July 2019-June 2020

Duration of the Field Study: September 15-29, 2019 and December 1-4, 2019

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Myanmar

National Sustainable Development Strategy (2009) and *Sustainable Development Plan (2018-2030)* are the development plans of Myanmar at the time of planning this project and at the time of the ex-post evaluation, respectively. Improving water supply and sanitation environment is an important goal in both development plans. At the time of planning, the water supply plan of Yangon City was the *The Study on Improvement of Water Supply System in Yangon City in the Union of Myanmar*, the development study conducted by JICA in 2002. At the time of the ex-post evaluation, the master plan proposed by JICA in the *Preparation Survey on the Project for the Improvement of Water Supply, Sewerage and Drainage System in Yangon City in the Republic of the Union of Myanmar* had been adopted as their water supply plan. This project is consistent with both master plans.

As mentioned above, the project had been consistent with the water supply development plan of the country from the time of planning to the time of ex-post evaluation.

3.1.2 Consistency with the Development Needs of Myanmar

At the time of planning, the need for improvement of the water supply facilities in Yangon City was high, because there were problems with water cuts, low water pressure, limited hours of water supply (average 16.5 hours per day), and water leakage (water leakage rate was 50% or more). Such a demand for facility development remains high even at the time of the ex-post evaluation. It is necessary to strengthen the capacity for water production, transmission and distribution and to draw up countermeasures for water leakage, in order to respond to the increasing water demand in the city.

In this project, the following three components which show the strong need and urgency for replacement and repair among the water supply facilities in the city were selected. These

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ③: High, ②: Fair, ①: Low

components are almost independent of each other in the water supply system, and the main service areas of these facilities do not overlap.

(a) Renewal of the Transmission and Distribution Pumps and Construction of a Pump House at the Nyaunghnapin First Phase Water Treatment Plant

(b) Renewal of the Distribution Main Pipeline at the Kaba Aye Pagoda Road

(c) Renewal of the Distribution Network in the Pilot Area in Yankin Township

(a) The transmission and distribution pumps at the Nyaunghnapin First Phase Water Treatment Plant provided 40% of the total water supply of the city, however, two of the four pumps were out of order and were suspended. The two pumps that were in operation also broke down frequently, because they had large cracks and water leakage, and because the water hammer prevention unit[4] was defective. The pump house also had large cracks in the wall due to uneven settlement and was not suitable for use.

Figure 1 Locations of the Three Components of the Project

(b) The distribution main pipeline at the Kaba Aye Pagoda Road was an aging pipe that had been installed more than 60 years ago. The pipe had been laid at the shoulder of the road; however, due to frequent road expansion, the pipe was now located exactly under the road. This has caused frequent water leakages from the pipe due to the impact of the wheel load of vehicles. Interruption to water supply and traffic congestion due to the repairs were serious problems.

(c) The pilot area of Yankin Township had water leakages every day, caused by bursting of the aging distribution lines. In addition, the water supply pressure for each household was reduced, because water distribution lines were poorly organized as a result of continuous extension and connection of pipelines without an appropriate plan.

These facilities are essential for the water supply services in the city even at the time of the ex-post evaluation.

Therefore, the project is considered to be consistent with the development needs of the water supply sector of the country at the time of planning and ex-post evaluation.

[4] A unit to avoid risk of damages to the pump due to the backflow from the transmission line.

3.1.3 Consistency with Japan's ODA Policy

This project was relevant to the specific measure of "development of health and medical services" and the "development of necessary infrastructure and systems for sustainable economic growth" that were formulated as a priority area of the ODA policy of Japan at the time of planning in order to improve the livelihood of the citizens of Myanmar, showing consistency with the policy.

As mentioned above, this project fits to Myanmar's development plan and development needs as well as Japan's ODA policy, and the relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The main outputs of the components of the project were as follows:

(a) Renewal of the Transmission and Distribution Pumps and Construction of a Pump House at the Nyaunghnapin First Phase Water Treatment Plant

In this component, four transmission and distribution pumps of the Nyaunghnapin First Phase Water Treatment Plant were renewed, and a pump house was constructed. The main outputs are shown in Table 1, which were in accordance with the plan.

Table 1 Actual Outputs of the Improvement of the Nyaunghnapin First Phase Water Treatment Plant

Construction of a Pump House	・ Foundation work ・ Construction of a pump house (basement: reinforced concrete/ground floor: brick construction) ・ Facility construction (doors and windows, lighting, overhead traveling crane, floor drainage pump, etc.)
Facility related to Pumps and Motors	・ Installation of four transmission and distribution pumps (2,850 m^3/hour, pumping head 72 m, motor output 800 kw) ・ Installation of electrical control panels and wiring materials ・ Installation of pipes and valves attached to the pumps ・ Installation of water hammer prevention unit ・ Construction of an inlet pipe connected to the existing water treatment tank and an outlet pipe connected to the existing transmission line

Pump House (at the time of planning)

Pump House
(at the time of ex-post evaluation)

Transmission and Distribution Pump
(at the time of planning)

Transmission and Distribution Pump
(at the time of ex-post evaluation)

Note: The photos taken at the time of planning were reproduced from the preparatory survey report for this project, and the ones for the ex-post evaluation were taken by the external evaluator.

(b) Renewal of the Distribution Main Pipeline at Kaba Aye Pagoda Road

In this component, approximately 1.5 km of the distribution main pipeline along the Kaba Aye Pagoda Road was renewed. Table 2 shows the planned and actual outputs of the pipe laying. As a result of measurement at the time of detailed design, the pipeline extensions were reduced from the planned number[5]. Ancillary works, including construction of a water pipe bridge, installation of valves, connection to the seven existing lines, installation of four fire hydrants, and restoration work of the pavement, were also carried out.

[5] At the time of project planning, the numbers of bypass pipelines of 300 mm and 200 mm were assumed by predicting the location of connections between the distribution main pipeline and the bypass pipelines, and the amount of water distribution. At the time of the measurement survey performed during the detailed survey, it was found that the number of locations of connections and amount of water distribution were fewer than assumed. As a result, the extensions of the bypass pipelines of 300 mm and 200 mm were reduced compared to the plan. Moreover, some locations to which 300 mm bypass pipelines were planned to be laid were found to be adequate for 200 mm, because the amount of water distribution at these locations was less than assumed. 200 mm pipes were laid for these locations, and this is another reason why the number of 300 mm bypass pipeline was reduced.

Table 2 Planned and Actual Outputs of the Renewal of the Distribution Main Pipeline at Kaba Aye Pagoda Road

Items	Diameter (mm) and material	Pipe laying extension (m)	
		Plan	Actual
Distribution main pipeline	1,000 ductile	1,700	1,567
Bypass pipelines	300 ductile	1,200	241
	200 ductile	1,400	1,173

Source: The planed figures refer to the preparatory survey report, while the actual figures are taken from the project completion report.

(c) Renewal of the Distribution Network in the Pilot Area in Yankin Township

Renewal of the distribution network, installation of control valves, air valves and water pipe bridges, setting up the valve chambers and a flow meter room, water supply connections and installation of individual water meters to the households in the target area were conducted in this component according to the plan. Around 500 households were planned to be included in the target area of this component. The project planned to establish a DMA (District Metered Area[6]) in the target area by making it hydrologically independent. However, the target area was expanded to include around 2,000 households. This was because the number of households which a DMA covers in the future was deemed to be around 2,000, and it was desirable to have a corresponding number of households in line with future prospect. The revised number of households in the target area was 1,945, which was almost four times that of the plan.

Table 3 shows the planned and actual outputs of the renewal of the distribution network. The pipe laying extension was increased due to the expansion of the target area as mentioned above.

Table 3 Planned and Actual Outputs of the Renewal of the Distribution Network in the Pilot Area in Yankin Township

Diameter (mm)	Material	Pipe laying extension (m)	
		Plan	Actual
400	Ductile	40	24
350	Ductile	620	1,674
200	Ductile	370	1,152
150	PVC	0	152
100	PVC	2,460	4,679
Total		3,490	7,681

Source: The planned figures refer to the preparatory survey report, while the actual figures are taken from the project completion report.

[6] DMA is a small segment in a distribution network that is hydraulically independent. The purpose of DMA is to reduce non-revenue water by measuring the amount of all water entering and exiting the area with a flow meter and monitoring the amount of water used in the area.

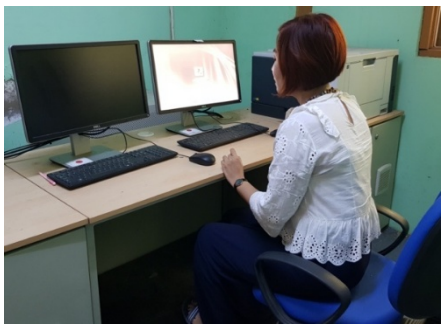
Water supply line installed in a house in Yankin Township

Individual water meters installed in Yankin Township

A set of transmission equipment for monitoring the DMA in the target area was installed in this component. This equipment includes a flow meter, flow indicator, water pressure indicator, chlorine indicator, equipment control unit and uninterruptible power supply unit, which were installed in Yankin Township, and a desktop computer, a printer, and a communication modem, which were installed in the monitoring room of Yegu pumping station. This equipment enabled Yegu pumping station to receive data on the flow rate, water pressure and chlorine content in the DMA in real time using internet communication. The purpose of installing this equipment was to estimate and calculate the non-revenue water (NRW) ratio[7] by aggregating and analyzing the received data in a computer and comparing the data on the water distribution volume and the metered water volume.[8]

A capacity-building program aiming at providing technical guidance on data analysis and management of water distribution using this DMA monitoring system was also implemented as planned.

Data recording equipment for DMA monitoring system installed in Yankin Township



Monitoring equipment for the DMA monitoring system installed in Yegu pumping station

[7] Non-revenue water is the water not counted for tariff collection due to leakages or theft from distribution pipes. Non-revenue water ratio is the ratio of non-revenue water out of the distributed water quantity.

[8] The DMA monitoring system is useful for early detection of water leakage and theft, because it can monitor the change in volume of water distribution continuously. It is also useful to identify leakage points in the DMA by monitoring water distribution data while opening and closing valves in the DMA one by one late at night, when water usage volume is less.

As mentioned above, all planned facility developments were implemented. There was a change in the number in component (b); however, it was implemented in the consequences of actual measurement and confirming the necessity. The target area of component (c) was expanded to around four times.

As described above, the project produced more outputs than originally expected.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The estimated project cost was 1,901 JPY million and the actual cost was 1,864 JPY million which came in under the budget (98%). The design and construction cost of the renewal of component (c) increased because the target area was expanded. The surplus amount generated as a result of efficient bidding for component (a) was allocated for the cost.

3.2.2.2 Project Period

In this project, construction work was implemented by dividing the three components into two contracts. The detailed design and bidding of component (a), which was more urgent, were conducted in advance so that the construction work would be completed early. Then, the detailed design, bidding and construction of components (b) and (c) followed. The project period was planned for 22 months and the actual period was 32 months; the actual period exceeded the plan (145%).[9] The main reasons for delay in the project period were changes in the design due to the expansion of the target area of component (c), and a re-bidding becoming necessary for components (b) and (c) because the bidding price did not fall below the expected price due to depreciation of the Japanese yen at that time.

Although the project cost fell within the planned budget, the project period was extended. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[10] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

As described in the "Background of the Project," the three components of the project were almost independent as water supply systems, and they were expected to create different effects. For that reason, in this ex-post evaluation, the status of achievement of the objectives expected for each component was individually verified, and these results were holistically taken into consideration to determine the effectiveness of the project.

[9] The project period concerning both the planned and actual outputs started on the commencement date of the detailed design and completed on the completion date of the constructions of components (b) and (c).
[10] Sub-rating for Effectiveness is to be implemented taking consideration of Impacts.

Table 4 shows the status of achievement for the indicators of the three components. The target of component (a) was mostly achieved, and the targets of components (b) and (c) were achieved. As will be described later, the effects of the project were confirmed from various information collected before and after the project in relation to these components. Thus, the effectiveness is high.

Table 4 Status of Achievement of the Indicators of each Component

Indicators	Baseline	Target	Actual	
	2012	2018 (3 years after project completion)	2019	
			Value	Level of Achievement
(a) Transmission time at Nyaunghnapin First Phase Water Treatment Plant (pump operation hours/day/unit)	16.7	24.0	22.9	95%
(b) Number of bursts of the distribution main pipeline	17 times/ 2 years	0/year	0/year	100%
(c) Water leakage rate at the target area in Yankin Township	Over 50%	10%	8% or less	Achieved

Source: The baseline and target figures refer to the preparatory survey report, and the actual figures are based on the responses to the questionnaire of the ex-post evaluation.

(a) Renewal of the Transmission and Distribution Pumps and Construction of a Pump House at the Nyaunghnapin First Phase Water Treatment Plant

With this component, pumps that were not operating sufficiently due to aging and malfunction were replaced. At the time of planning, it was expected that the new pumps would be functioning 24 hours a day. At the time of the ex-post evaluation, these pumps were almost fully running, and the average daily operating hours in 2019 was 22.9 hours (95% target achievement) as shown in Figure 2. The average daily operating hours was less than 24 hours because sometimes one of the three pumps were stopped and only two operated when water demand decreased during nighttime, and because sometimes the pumps were stopped due to power cuts. The pump operation has never stopped due to a failure of the pumps. The amount of water transmitted by the pumps increased significantly after completion of the project (Figure 3). Pump outages (a day when the pump is shut down for 24 hours) and water hammer accident have never occurred, although they occurred frequently at the time of planning.

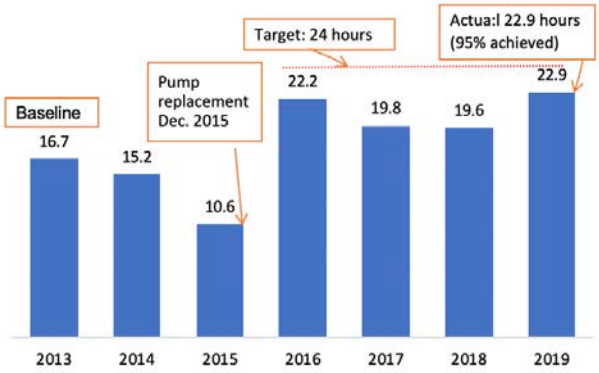


Figure 2 Average Operating Hours of Pumps per Day

(Unit: hour/day/unit)

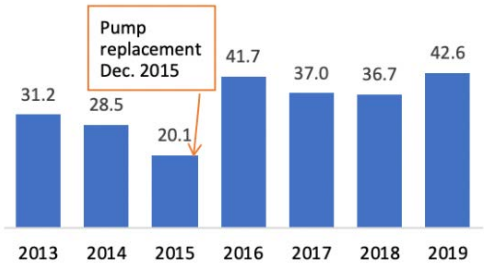


Figure 3 Average Water Transmission Volume of Pumps per Day

(Unit: Million Gallons/day)

Source: Prepared by the evaluator based on the responses to the questionnaire of the ex-post evaluation.

The number of water supply connections[11] using the water transmitted and distributed by the above-mentioned facility increased from 35,900 at the time of planning to 43,340 at the time of the ex-post evaluation. This was realized as a result of the distribution network in the distribution area of the water treatment plant being expanded and connected to new consumers, not only because of the increase in transmission hours and volume resulting from the development of facilities by the project, but also because the Water Resources and Water Supply Agency of YCDC replaced a part (19 km) of the transmission line of Nyaunghnapin First Phase Water Treatment Plant from 36-inch concrete pipe to 48-inch cast iron pipe after the completion of the project, reinforcing the transmission capacity.

(b) Renewal of the Distribution Main Pipeline at Kaba Aye Pagoda Road

At the time of planning, the distribution main pipeline frequent burst – as frequently as 17 times in around 2 years, from June 2010 to August 2012. Interruptions to traffic flow due to repairing pipe bursts were also a problem. It was expected that the project would solve such problem of interruptions to traffic flow. Accordingly, the effectiveness of this component was evaluated using the occurrence of interruptions to traffic flow due to repair of bursts to the distribution main pipeline as an effect indicator. After completion of the project, no traffic interruption due to pipeline bursts had occurred, and therefore the objective of this component was achieved.

The number of connections through the distribution main pipeline increased from 2,583 at the time of planning to 3,621 at the time of the ex-post evaluation. At the time of planning, the pipeline was used for gravity transmission by natural flow. However, the Water Resources and Water Supply Authority connected the pipeline to the Yegu pumping station so that water could reach farther by pumping transmission, because the pipeline became strong enough to withstand pumping transmission due to the renewal conducted by the project. In order to make effective use

[11] The number of connections is the number of locations that distribution pipes are connected to water supply pipes.

of the pumping transmission, the Authority renewed the distribution pipeline leading to Kamayut Township which was branched from the main pipeline, the distribution network, and pressure pumps of the Township, extending connections to new consumers. An increase in the number of connections has been realized as a result of these efforts.

(c) Renewal of the Distribution Network in the Pilot Area in Yankin Township

There were frequent water leakages in Yankin Township Pilot Area due to the old and improperly arranged distribution pipelines at the time of project planning. It was expected that this project would solve this problem. The effectiveness of this component was planned to be evaluated based on the leakage rate in the target area. Before the project implementation this was 50% or more, and the target was 10% or less. According to data provided by the Water Resources and Water Supply Authority of YCDC, the non-revenue water rate in the target area after project completion was 8% in July 2017, and thereby the water leakage rate is estimated to be 8% or less.[12] Thus, this component has also achieved the targets set at the time of planning.

As shown in Table 5, the number of water leakage incidents has been significantly reduced, water supply pressure has been significantly improved, and revenue from water bills has increased in this area.

Table 5 Status of Water Distribution and Supply in Yankin Township Pilot Area

Indicators	Status of water distribution and supply before and after the project
Leakage incident	Renewal of the distribution network significantly reduced the frequency of water leakages. Water leakages frequently occurred in the distribution network, and repair work was carried out every day before the project implementation. After project implementation water leakage rarely happened, and repair work was performed only twice in four years. These repairs were needed because a vehicle collided into the hydrant, and not because of a defect in the distribution network.
Water supply pressure	Water pressure was drastically improved because effective water volume was increased. This was attributed to the fact that the pipeline network was designed to distribute water effectively and that water leakages were not observed. Before project implementation water supply pressure was low, and households on the second floor or higher of apartment complexes had to pump water to their rooms using water pumps directly connected to the supply pipeline. These pumps sometimes drew surface water and underground wastewater when there were water leakages (source: Preparatory survey report of the project). After the project implementation, water is supplied to the 4th floor of apartment complexes without using such a pump, and no household was using the pump at the time of the ex-post evaluation.

[12] Non-revenue water includes water for which tariffs were not collected due to water theft or because a meter was not installed, in addition to the water that leaked from distribution pipelines. Therefore, the water leakage rate is lower than the non-revenue water rate.

<table>
<tr><th>Indicators</th><th>Status of water distribution and supply before and after the project</th></tr>
<tr><td>Income from water supply</td><td>The project installed water meters on 1,945 households in the target area as explained in “3.2.1 Outputs.” As a result, the average monthly tariff revenue per connection has significantly increased when compared to the amounts before and after the project (see the table below). During this period the water tariff has not been revised.[13]
<table>
<tr><th>Year and Month / Items</th><th>January 2016
Before construction</th><th>June 2016
Just after construction</th><th>July 2019
At the ex-post evaluation</th></tr>
<tr><td>Monthly income from water supply (Kyat)</td><td>2,784,600</td><td>3,229,080</td><td>5,815,466</td></tr>
<tr><td>Number of water supply connections</td><td>1,547[14]</td><td>1,570</td><td>1,746</td></tr>
<tr><td>Average monthly income from water supply per connection (Kyat/month/ connection)</td><td>1,800</td><td>2,057</td><td>3,331</td></tr>
</table>
Source: Responses to the ex-post evaluation questionnaire</td></tr>
</table>

3.3.1.2 Qualitative Effects (Other Effects)

A qualitative survey was conducted for consumers in the water supply and distribution areas of each component.[15] It was conducted to understand examples for improvements in water supply services in the beneficiary areas of the project. As a result, it was found that improvement of water supply services, including extension of hours of water supply, elimination of interruption of water supply, and increased water pressure and volume, were realized in the beneficiary areas of the project.

For example, the pressure and volume of water supply using the Kaba Aye Pagoda Road distribution main pipeline which was renewed by the project was increased after project completion, making it possible to distribute water to areas where water had not been supplied for the past 20 years. (See the column below).

[13] The latest tariff revision was conducted in April 2012. It is 88 kyat/m^3 for households installed with meters and the basic charge is 100 kyats. The fixed charge for households without meters is 1,800-3,000 kyats (as of November 2019).
[14] The reason why the number of water meters installed (1,945 households) is larger than the number of water supply connections (1,547 locations) is that the distribution line is connected to a building at a single point, but water meters are sometimes installed at each shop or other units in the building.
[15] Four group discussions were held. The total number of participants was 33 (21 males and 12 females). In addition, visits were paid to four households, and two primary schools, and one township hospital.

【Resumption of water supply in an area where water had not been supplied for the past 20 years】

Water supply services had stopped for about 20 years because water supply facilities were old and had deteriorated in the residential area near Inya Lake Road in Kamayut Township. The residents had been demanding a resumption of water supply services because the quantity and quality of the groundwater in the area was poor. The distribution main pipeline at the Kaba Aye Pagoda Road, which had frequent leakages, was renewed by the project, and became able to withstand pressure distribution. The Water Resources and Water Supply Authority improved the distribution pipes leading from the distribution main pipeline to the township and the distribution network within the township and restarted the water supply service in the area after completion of this project. The result of interview with a resident in the area is described below.

Interview with a household (family of four)

We used well water before, but because the smell is like iron and the color is yellow, we were worried about using it for domestic water. Clothes turned yellow when we used well water for washing. We applied for a connection when we came to know that the water supply facilities had been renewed, and the service resumed. We are very satisfied with the service as the quality of the piped water is good and it can be used for cooking with peace of mind.

3.3.2 Impacts

3.3.2.1 Intended Impacts

It was expected at the time of planning that improvement of water supply services by the project would contribute to improving the living environment of the local community. As a result of the qualitative survey described above, it was found that the project contributed to an improvement in the living environment of the local community as follows (see also the column below).

- With the elimination of water cuts and increased hours of water supply, we can now use water immediately when we want to use it at home, such as for washing clothes and taking a shower. Even in primary schools, the water needed for washing hands and cleaning toilets is always available. This has made life easier and improved hygienic behavior.
- Electricity costs and working time have been reduced because there is no need to use a pump to pump well water or lift tap water to the upper floors of the apartment complex.
- In the past, water was supplied only once every few days and only late at night. When water came on in the middle of the night, we stored it in a tank as much as possible. After the project was implemented, water is also supplied during the daytime, so there is no need to secure water at midnight. We can sleep at night without any worries.

- Well water made our laundry yellow and could not be used for cooking because the quality was poor. After the project, high quality tap water became available for washing and cooking at ease.

There was no example found in health improvement. This is probably because the relationship between improvement of water supply services and health improvement is weak. At present, the pipe water has impurities, although the Water Resources and Water Supply Authority of YCDC is working on improving the quality of water. Because of this situation, every household purchase drinking water.

【Improvement of water supply service through the project contributes to improvement of living environment for the local community】

Interview with a household living on the second floor of an apartment complex in Yankin Township

We were using a pump to lift water to the room in the past, because water pressure was low. However, we couldn't pump water to the room during frequent power outages, which was very inconvenient. There were power outages at least one hour and up to 6 hours a day. This sometimes happened every day during the dry season. Water is supplied to the room without the use of a pump after the facility was renewed, making our lives much easier. We no longer have to pay electricity bills for pumping. Water is supplied regardless of the power outages, and we are satisfied with the water supply service in terms of its quality and quantity.

Interview with the director of the Mingaladon Township Hospital (25 beds)

We pumped up large quantities of well water for usage at the hospital until three years ago because piped water was scarcely supplied. We had to stop the pump motor when it got hot and start it when it cooled down, for a total of around 5 hours every day. The amount and pressure of the piped water supply improved after the improvement of the facility, and water became available 24 hours a day except when it is interrupted due to a power outage. There is no need to pump well water, saving on the electricity bill and reducing the workload.

3.3.2.2 Other Positive and Negative Impacts

According to the consultant in charge of this project, the project planned to use low-noise excavators and generators during construction and stop dump truck engines during loading of earth and sand, giving consideration to the surrounding residents. This has been done on the Kaba

Aye Pagoda Road, the target area of component (b), main road connecting Yangon City and Yangon Airport. The jacking method[16] introduced for the first time in the country was effective in alleviating traffic congestion when the distribution main pipeline was laid under the road. Construction works for the component (a) were executed within the water treatment plant, and environmental impact was not anticipated. As expected, no issues have been occurred. Based on the monitoring plan, monitoring of noise and vibration was conducted monthly for components (b) and (c), which were conducted in the city. World Bank standards were used as reference values since Myanmar does not have environmental standards. The measurement value did not exceed the reference value to a great extent and overall values did not appear to be problematic. There was no complaint or claim from residents about the construction in all components.

A worker died at the construction site for the pumping house one month after commencement of construction. This was qualified as an accidental death by an electric shock due to negligence of safety measures. It might have been prevented if sufficient safety measures had been taken from commencement of the construction. The construction was resumed after the contractor paid compensation to the family of the worker and implemented proper safety measures, including enhancement of the construction management system, update of construction plan, specific designation of safety officers and creation of safety procedure manual, and improvement of temporary electrical equipment and work environment. There was no objection or action against the project by the local community because necessary measures and compensation payment were made promptly. No accident was caused after that. The scope of the negative impact created by the accident was minimized by appropriate measures taken after the accident, and it is considered that the impact of the accident on the overall impact of the project is limited.

There was no resettlement or land acquisition by this project.

From the above, the project effects are present just as planned and its effectiveness and impacts are recognized as high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

In 2018, the Department of Water Supply and Sanitation was reorganized in accordance with the revision of the YCDC Law and separated into the Water Resources and Water Supply Authority, which is responsible for water supply services, and Wastewater and Sewage Management Authority, which is responsible for sewage services. Figure 4 shows the organization chart of the Water Resources and Water Supply Authority.

[16] The pipe jacking is a technique for installing water pipes to underground. Water pipes are installed underground pit excavated by a drilling machine and are moved forward by a jacking machine one by one. This method requires less excavation of ground surface compared to the conventional excavation method, and it enables reduce vibration and noise caused by excavation and traffic congestion due to road blocking.

Despite the organizational reorganization and name change, there was no change in the composition and responsibilities of the sections within the Authority concerning water supply, and these changes had no effect on the operation and maintenance of this project. The Authority has a total of 2,852 staff members allocated.

The pump house of the Nyaunghnapin First Phase Water Treatment Plant is under the purview of Ngamoyeik Water Treatment Plant. The water treatment plant has a total of 116 staff members, and the responsibilities and roles of each department are clear. Necessary personnel were assigned at the water treatment plant and the pump house developed in the project for operation and maintenance.

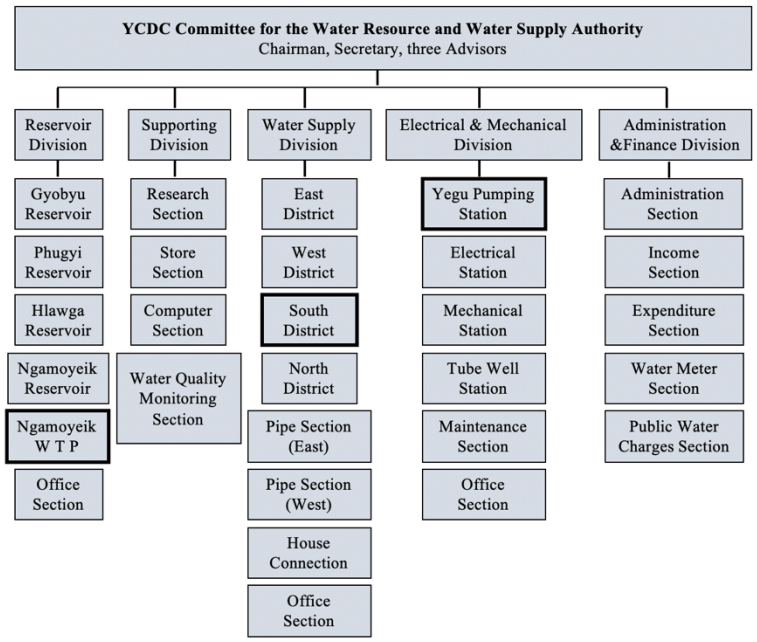


Figure 4 Organizational Chart of the Water Resource and Water Supply Authority of YCDC (as of December 2019)

The Pipe Section of the Yegu Pumping Station is in charge of maintenance of the Kaba Aye Pagoda Road distribution main pipeline. The Yankin Township Office is under the purview of the South District Office. The office has a total of 29 staff members, and their roles and responsibilities have not changed since the time of planning. The staff required for the operation and maintenance of the water distribution facilities developed in the project, meter readings, and fee collection are secured.

As mentioned above, there is no systematic or institutional issue that could hinder the sustainability of the project.

3.4.2 Technical Aspect of Operation and Maintenance

There is no facility and equipment in the project that is either not used or extremely inactive due to technical problems.

No technical problems have occurred with the data collection and analysis in the DMA monitoring system. Staff members record and analyze daily and monthly data and produce reports. NRW Management Section has learned how to calculate non-revenue water ratios. Staff of the Yankin Township office are recording leakages and estimating the amount of leakage with the support of a JICA long-term expert and from the technical cooperation project “The Project for

Improvement of Water Supply Management of YCDC" (hereinafter the "Technical Cooperation Project"). The Authority has purchased flow meters and leak detectors and plans to implement countermeasures for leakages by using these devices. The Water Resources and Water Supply Authority has been providing training for managers, new employees, pump operators and others to build their capacity, with support from the above-mentioned technical cooperation project.

As described above, there are no problems relating to the technical aspects of operation and maintenance of facilities developed in the project.

3.4.3 Financial Aspect of Operation and Maintenance

The Water Resources and Water Supply Authority is not an independent entity but remains to operate the water supply service since the planning of the project with a budget allocation as a department within the YCDC. After completion of the project, the Authority took advantage of annual budget to develop facilities that would expand revenue and to make good use of facilities improved in the project. The column【Resumption of water supply in the area where water has not been supplied for the past 20 years】on page 15 is one example. Each township office of the Authority plans to extend the distribution network and number of connections in the target area of the project in future with their budget. Further, it is expected to make effective use of the facilities developed in the project.

According to the breakdown of income and expenditure, tariffs account for 91% of income (Figure 5), and the main item of capital expenditure is water distribution projects (Figure 6). The main items of operational expenditure are electricity bills, purchasing of goods and labor costs (Figure 7).

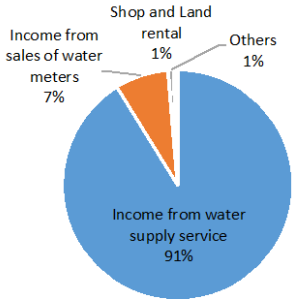


Figure 5
Income FY 2017

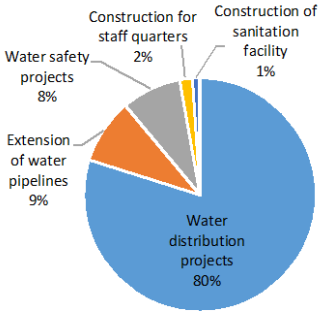


Figure 6
Capital Expenditure FY 2017

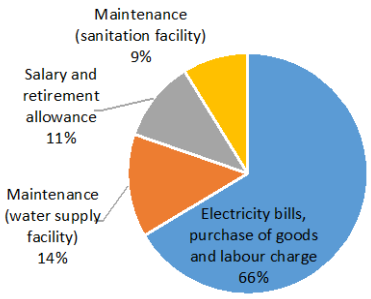


Figure 7
Operational Expenditure FY 2017

Note: All figures are actual numbers in FY 2017 (from April 2017 to March 2018)
Source: Responses to the ex-post evaluation questionnaire

Table 6 shows the income and expenditure of the Authority for the last three years.[17] Revenue is delivered to the national treasury through YCDC. The expenditure is covered by the budget distribution from YCDC.

Table 6 Income and Expenditure of the Water Resource and Water Supply Authority

（Unit：million Kyats）

Items	FY 2016	FY 2017	FY 2018 1st half
Income in total	12,104.343	13,772.791	5,989.607
Capital expenditure	14,919.868	40,246.935	33,021.079
Operational expenditure	18,153.377	18,150.290	10,772.863
Expenditure in total	33,073.245	58,397.225	43,793.942

Source: Responses to the ex-post evaluation questionnaire

As Table 6 shows, the expenditure of the Authority has exceeded its revenue, and it does not have financial independence. From the viewpoint of sustainability of the water supply service, it is desirable to have financial independence as an institution for water supply and improve the financial situation by increasing tariffs. Although the Authority is aware of the importance of these factors, the tariffs for water supply of the city have not been increased since April 2012 for political reasons. The Authority has not taken any specific measures for financial independence, although it is a future goal.

However, the budget necessary for operation and maintenance of the facilities developed in the project has been secured under the current financial system, and there are no financial problems that would hinder the sustainability of the effects of the project.

3.4.4 Status of Operation and Maintenance

(a) Pump Station of the Nyaunghnapin First Phase Water Treatment Plant

The pumps in the water treatment plant are operating smoothly, and maintenance work, including operation, lubrication and inspection, is carried out properly by maintenance staff of the water treatment plant management office. There are no defects in the components of the pump house. Daily inspection of moderate leakage from the pump shaft seals during operation, monthly checks of water level and drainage of air valves, monitoring of water meter values of the transmission pipeline, and periodic cleaning of the flow meter, which were suggested in the defect inspection, are also implemented.

The figures had not been displayed on the monitoring panels of the pumps since mid-2018. The staff checks the flow meter and measuring instrument of the pump’s operation panels and

[17] Myanmar's fiscal year was from April to the end of March of the following year. However, the fiscal year has changed from October to September of the following year from mid-2018. Therefore, the financial period for 2018 is the first six months from March to September.

records the measured value every hour for important monitoring items during operation such as pump flow rate, motor voltage and current. The problem of the display has not hindered the operation of the pumps. The temperature of pumps and motor bearings is checked by hand. However, a monitoring panel is required to check the water transmission pressure, the differential pressure of air valves, and the opening ratio of transmission valves. The head of the water treatment plant is aware of this situation and has already purchased a PLC (programmable equipment control device), which is a necessary part for repair of the panels. At the time of the ex-post evaluation, the head of the water treatment plant had referred to a specialist who could install the necessary programs for the installation of the PLC. He stated that they would like to install the parts as soon as possible and resume using the monitoring panels.

(b) Kaba Aye Pagoda Road Distribution Main Pipeline

The renewed distribution main pipeline had no defect or leakage, and the valves and hydrants are in good condition without any problems. The air valves with replaced parts at the time of the defect inspection, are functioning without problems.

(c) Distribution Network at the Pilot Area in the Yankin Township

The renewed distribution network is in good condition with no leak or defect. The water meters installed in each household are functioning without any problems. The staff scraped off and cleaned soil accumulates in the water meter box, if any, at the time of meter reading. It was pointed out that the filter in the meter had to be cleaned at the time of the defect inspection. This is to prevent the filter from being clogged by impurities in the water and causing measurement failure. The Yankin Township Office only carries out this cleaning when there is a complaint from a consumer and does not conduct the proposed annual cleaning.

The data recording unit of the DMA monitoring system is functioning normally, and data is recorded daily and monthly. Staff in the monitoring room of the system received and analyzed the data and produced reports. A software defect was found in the system in late 2017. Although the warranty period had expired, the supplier of the system dispatched a technician from India, taking into account the importance of the problem. He inspected and repaired the defect free of charge. Thereafter, the environment of the internet service which is needed for receiving the data, was changed, and the Authority changed the internet service provider. As a result, the system was functioning without problems in December 2018.

However, the speed of the internet became extremely slow; it has become impossible to receive the data for flow rate continuously, and it is taking a long time to boot the system after a power failure since January 2019. The data received is recorded daily and monthly, and reports are being prepared and submitted. However, the NRW ratio cannot be calculated because there is missing data. With regard to this issue, the Water Resources and Water Supply Authority mentioned that

they would like to find measures to integrate and operate the DMA monitoring system introduced in the project with the transmission monitoring system introduced in the above-mentioned technical cooperation project, as well as with the DMA monitoring systems to be introduced in several townships in the city by the two ODA loan projects which are being implemented at the time of ex-post evaluation.[18]

The external evaluator found that the flow rate was about three times higher than the consumption volume when she examined the monitoring results for December 2018, for the month almost all data was available. She informed the Water Resources and Water Supply Authority that the distribution network may have extended outside the DMA, and if there was an extension it would be necessary to install a flow meter at the extension point to keep the DMA measurable. The Agency responded that they would check for any extension and take necessary measures.

As described above, the operation and maintenance status of the facilities constructed under the project is generally favorable, and some defective parts and attached facilities are expected to be repaired or improved.

No major problems have been observed in the system, the structure, technical/financial aspects, or in the current status concerning the operation and maintenance in the project. Therefore, sustainability of the project effects is high.

【Timely and multi-dimensional assistance for improving water supply services in Yangon City】

This project developed the facilities identified most urgent and important in the "Study on the Improvement of Water Supply and Waste Water Treatment in Yangon, the Republic of the Union of Myanmar," which was conducted by the Ministry of Economy, Trade and Industry of Japan just after the country had shifted to civilian rule in 2011, as described in the "Background" of this report. The water transmission and distribution pumps at the Nyaunghnapin First Phase Water Treatment Plant were renewed in the project after confirming its urgency in the study. Afterwards, the pumps had been submerged and became inoperable. An emergency situation would have occurred in which 40% of the total water supply of the city would have stopped if the pumps had not been renewed in this project. This indicates that the study conducted in 2011 was very timely. A grant agreement was signed for the project shortly after the study, and the component of the water treatment plant was completed in 2015. This was a speedy response to the urgency.

JICA conducted the "Preparation Survey on the Project for the Improvement of Water Supply, Sewerage and Drainage System in Yangon City in the Republic of the Union of

[18] "Greater Yangon Water Supply Improvement Project (Phase I)" and "Greater Yangon Water Supply Improvement Project (Phase II Stage 1)."

Myanmar" following the above study, since 2012. The study proposed future plans and targets for Yangon water supply in 2014. The study set the targets of water supply services and showed the path to achieve them at a time when a rapid increase in water demand of the city had started due to population growth and urbanization at the democratization advances in the country. It was an indispensable arrangement for implementation of the subsequent programs. At present, the YCDC has adopted the proposal from the study as a master plan for water supply in the city and has been working on improving water supply services by utilizing technical and financial assistance from JICA, including technical cooperation projects, ODA loan projects, dispatch of experts, and grant aid with a service concession arrangement project of the Ministry of Foreign Affairs of Japan.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project supported the improvement of water supply services in Yangon City by upgrading facilities that needed urgent rehabilitation.

From the time of project planning to the ex-post evaluation, improvement of water supply and sanitary conditions was a priority issue for the country, and there was a high need for improvement of water supply services in Yangon City. It has been recognized that the project was consistent with the development policy and needs of the country and also consistent with Japan's ODA policy of providing support to improve the lives of the citizens of Myanmar. Consequently, the relevance of the project is considered to be high. All planned facility construction was conducted, and the project cost did not exceed the budget. Since the project period was longer than expected, the efficiency of the project is considered to be fair. There were three components in the project. In the first component, (a) "Renewal of the Transmission and Distribution Pumps and Construction of a Pump House at the Nyaunghnapin First Phase Water Treatment Plant", the defective pumps that were not properly functioning were replaced. At the time of the ex-post evaluation, the renewed pumps were almost fully operational, with an average daily operating time of 22.9 hours. In the second component, (b) "Renewal of the Distribution Main Pipeline at the Kaba Aye Pagoda Road", the aging distribution main pipeline was renewed. Since the completion of the project, traffic has not been interrupted due the pipeline bursting or for its repair, and the expected outcome was achieved. In the third component, (c) "Renewal of the Distribution Network in the Pilot Area in Yankin Township", the aging distribution network was updated in the area. This solved the problem of frequent water leakage and reduced the rate of water leakage to 8% or less as planned. Improvement in the water supply service, including increased hours of water supply, resolution of the problem of water cuts, increased water pressure and quantity, improvement of the living environment, including reduction in the cost of electricity and working hours of the water pumps, and an improvement in hygienic behavior, were realized. Therefore, effectiveness and impact of

the project are high. No major problem has been observed in the policy system, the structure, technical/financial aspects or in the current status concerning the operation and maintenance of facilities developed in the project. Further, some malfunctioning parts and attached facilities are expected to be repaired or improved. It is observed that sustainability of the project effects is high.

Considering these observations mentioned above, the project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Measures to resume function and utilize the DMA monitoring system at Yankin Township (Recommendation to the Water Resources and Water Supply Authority)

The DMA and DMA monitoring system introduced to Yankin Township in the project were expected to be a model for DMA formation and water distribution monitoring in the country in future. However, at the time of the ex-post evaluation, the equipment did not receive data continuously, and the measured flow rate was around three times more than the consumption volume; therefore, it was not utilized for water distribution monitoring. The Water Resources and Water Supply Authority would like to repair and operate the device by integrating it with the water transmission monitoring system introduced in the technical cooperation project, as well as with the DMA monitoring system to be introduced to multiple townships in two ODA loans. However, to realize this, time and cost for technology development, such as software integration, will be needed. Therefore, until this happens, the Authority is recommended to improve the communication environment of the location of the equipment by introducing fiber-optic network, investigate if there is any distribution out of the DMA, and if there is, install a flow meter to the relevant distribution branch point, in order to keep the DMA measurable, and to make the system functioning and utilize it for the distribution management.

(2) Cleaning of filters in the consumer water meters once a year (Recommendation to the Yankin Township Office of the Water Resources and Water Supply Authority)

As pointed out in the defect inspection of the project, the Yankin Township Office is advised to clean the filters of the consumer water meters regularly approximately once a year, in order to prevent clogging of the water meter causing measurement errors.

4.2.2 Recommendations to JICA

(1) Monitor status of usage of the DMA monitoring system introduced by the project, its issues, and utilization of lessons learned

It is planned to construct DMAs and install DMA monitoring systems in several townships in two ongoing Japanese ODA loan projects. JICA is recommended to continue monitoring the status

of usage of the DMA monitoring system introduced by the project and to utilize the issues and lessons derived from the monitoring in the ongoing ODA loan projects.

4.3 Lessons Learned

Continuous follow-up is required when newly introducing a system such as a DMA monitoring system, which use software and internet services

In this project, a DMA monitoring system was newly introduced, and training on the operation of the system was conducted in the capacity building program. However, a problem occurred in the software of the system about a year after its introduction, and staff were unable to analyze the data. Fortunately, given the importance of the problem, the supplier dispatched a technician from India for free inspection and they made repairs and inspection even though the warranty period had expired. However, the communication environment was changed one year later, and the staff were unable to receive the flow data. At the time of the ex-post evaluation, the system was not functioning properly and was not fully utilized.

A system, such as a DMA monitoring system which require software and internet service, can have problems that cannot be solved with the knowledge acquired through the initial technical training on operation. Software failure is an example of such problem. It also requires continuous update of communication services responding to the changes of communication environment at the installation site. Therefore, it is necessary to ensure in advance that the suppliers, the local agents of the system or the executing agency are able to assist when problems occur, so that the system is used effectively on an ongoing basis.

For example, it is necessary to confirm that the supplier, the local agency, or the executing agency is continuously capable of managing, fixing and updating the software installed in the system. Regarding Internet communication, it is important to notify the executing agency that they may need to change the service provider or subscribe new services if communication environment at the place the system is installed changes. Obtaining their advance commitment for these actions are also important.

If there is no prospect for the above-mentioned follow-up work or the cost burden for the purpose, it should be considered not to introduce the system or introduce a simple system that does not need such follow-up work.