Republic of the Union of Myanmar

FY2018 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Upgrading Ferryboat in Yangon City"

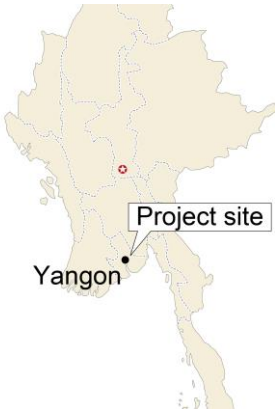
External Evaluator: Mana Takasugi, International Development Center of Japan Inc.

0. Summary

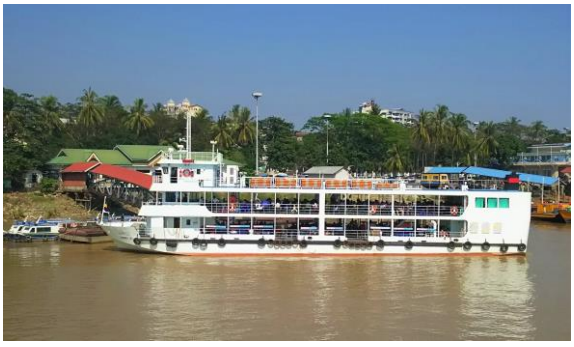
This project was implemented to improve the safety and reliability of the ferry service crossing the Yangon River by replacing existing unsafe old ferries with new ferries, thereby contributing to the improvement of infrastructure in the daily life of the Yangon people, especially in the Dalla area where many lower income people live. As the project is consistent with Myanmar's development policy, development needs, and Japan's assistance policy, the relevance of the project was high. The project cost was within the plan and the project periods were shortened by approximately one month. Therefore, the efficiency of the project was high. Operation and effect indicators were generally achieved except for one indicator. Although the "maintenance and repair cost" has not been achieved, the basis for the target set at the time of planning was insufficient, and the number of breakdowns per se has decreased compared to existing vessels. All of the safety issues pointed out for existing vessels have been resolved, and passenger comfort has been improved. By looking at the overall results of all effect indicators, it can be said that "improvement of safety" has been achieved. From the viewpoint of improving the mobility convenience, the impacts are emerging, and synergies with a technical cooperation project have also been observed. Based on the above, the effects of this project were largely as planned, and the effectiveness and impacts of the project were high. Considering that this project's balance of payments is in surplus and the operation and maintenance of ferries are carefully managed, no major problems have been observed in the institutional/organizational, technical, financial aspects and current status of the operation and maintenance system. Therefore, the sustainability of the project's effects is high.

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

1. Project Description



Project Location



The project ferry

1.1 Background

Myanmar has been promoting economic reform following democratization in 2011, and it has continued to mark economic growth at around 7% annually since 2012. While Japan had suspended large-scale ODA projects to Myanmar in response to the house arrest of Ms. Aung San Suu Kyi since 2003, with the democratization efforts of the new administration since 2011, Japan changed its economic cooperation policy for Myanmar in April 2012 and resumed full-scale cooperation, including ODA Loans.

Myanmar has developed an inland waterway network consisting of the Ayeyarwady River, which runs through the north and south of the country and many rivers diverge from it, and delta zones extend over coastlines. Of the population of 62.42 million (2011), 26.32 million people per year (FY2006) used inland water transportation, and its ratio to the overall transportation modes is high. The central part of Yangon, the largest city in the country, is also surrounded by rivers on three sides. The Dalla ferry connecting the central part of Yangon and the Dalla area, the residential district across the Yangon River, was used by more than 30,000 people per day since there were limited alternatives for crossing the river. Especially during the peak morning and evening hours, passengers overflowed, and the overloaded operation became normal. Furthermore, the safety of the ferries was an issue since this route had a fast flow and the traffic of large vessels was intense due to the proximity of Yangon Port; meanwhile the existing ferries in service had aged over 60 years since they were built.

Against this backdrop, this project was implemented to improve the safety and reliability of the ferry service by building three new ferries to replace existing vessels through grant aid and procuring equipment necessary to maintain them.

1.2 Project Outline

The objective of this project is to improve the safety and reliability of the ferry service crossing the river through the replacement of existing old ferries in Yangon with new ferries and the procurement of related equipment, thereby contributing to the improvement of infrastructure for the daily life of the Yangon people, especially in the Dalla area where many lower income people live.

Grant Limit / Actual Grant Amount	1,168 million yen / 1,166 million yen
Exchange of Notes Date /Grant Agreement Date	March 2013 / March 2013
Executing Agency	Inland Water Transport (IWT)
Project Completion	November 2014

Target Area	Yangon City
Main Contractor(s)	Nakatani Shipbuilding Co., Ltd.
Main Consultant(s)	Fisheries Engineering Co., Ltd.
Preparatory Survey	June 2012 – March 2013
Related Projects	Technical Cooperation "Urgent Project for Rehabilitation of Yangon Port and Main Inland Water Transport" (February 2009 – January 2015)

2. Outline of the Evaluation Study

2.1 External Evaluator

Mana Takasugi, International Development Center of Japan Inc.

2.2 Duration of Evaluation Study

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

Duration of the Study: November, 2018 – October, 2019

Duration of the Field Study: February 4, 2019 – February 16, 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

In the March 2011 Presidential Address to the House of Representatives, reference was made to the importance of correcting the gap between the rich and the poor, including ethnic minorities, and between regions. In the Dalla area, where many low-income people live, and in the medium-to-long-term, this project, which many of these people use, was expected to contribute to the achievement of stable societies by improving the living conditions of Yangon citizens. Therefore, the project was in line with the development policy of the country that aimed at reducing the gap between the rich and the poor and regional disparities.[3] The 20-Year National Comprehensive Development Plan (NCDP: FY2010-2030) effective at the time of the ex-ante evaluation also aimed at "expanding domestic and global connectivity and economic integration." Among the goals of the strategy, it is stated that particular emphasis would be placed on accelerating connectivity of less developed areas to widely distribute the benefits of economic growth. It also stipulates policies for reducing poverty, inequality and regional disparities.

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

[2] ③: High, ②: Fair, ①: Low

[3] Source: Preparatory Survey Report

In contrast, the “Myanmar Sustainable Development Plan” (MSDP, FY2018-2030), which is being implemented at the time of the ex-post evaluation, stipulates that the government “seeks to provide for the safety and security of our people by enhancing human security in all its forms and enabling the development of both hard and soft connectivity to help reduce the rural urban divide in terms of access to markets, to information, to technology, to finance, to education, to basic infrastructure and healthcare, amongst others.” The action plans include, “develop sustainable public transport systems that are safe, convenient and accessible to all.” Since the Dalla ferry is used for commuting to schools and workplaces from the Dalla area to central Yangon, the project is consistent with the above-mentioned policies. In addition, transport policies such as the “Comprehensive Urban Transport Plan of the Greater Yangon” and the “National Transport Master Plan” indicate the importance of inland water transport and the importance of renewing old vessels.

In this way, the importance of correcting the gap between the rich and the poor and regional disparities in Myanmar's policies, as well as the emphasis on strengthening connectivity, has remained unchanged before and after this project. The importance of the inland water transport and renewing aged vessels has also been pointed out. Therefore, this project is highly consistent with Myanmar's development policies.

3.1.2 Consistency with the Development Needs of Myanmar

At the time of planning, the target ferry route, connecting the center of Yangon and the Dalla area, a residential area on the opposite side of the Yangon River, was a trunk ferry route used by over 30,000 people per day for commuting to school and workplaces. There was an overflow of passengers, especially during the peak hours of the morning and evening, and the overloaded operation became normal. Furthermore, the existing ferries were 67-year-old ships (as of the Preparatory Survey) built in 1945, whose service life was exceeded. They were unsafe as public transportation ferries, and it was difficult to operate the service stably, because their hulls had considerable buckling and damages, and they sometimes suffered from flooding due to holes in the bottom shell plate, which rarely occurs in ordinary vessels. Moreover, the machinery to clean the soil on the bottom of the docked ship and to remove rust was not utilized as it was discarded due to failures. Since the surface of the ship was painted with rust, the progress of rust was quick, and a quarter to one third of the ship's bottom shell had to be replaced every year.[4]

At the time of ex-post evaluation, the number of passengers per day was 26,000-28,000 (average of 27,000 in January 2019, based on the data provided by IWT), which was a slight decline from the time of the Preparatory Survey, but was nearly the same, and the number of safe and inexpensive alternative transportation methods was still limited. As a result, the

[4] Source: Preparatory Survey Report

status of the ferry route as the key commuting route used by many residents of the Dalla area has not changed.

At the time of the project planning, the fact that the demand for this ferry route has not declined was regarded as an important assumption for achieving the plan. For many years, the Korea-Myanmar Friendship Bridge between Yangon and Dalla had been planned, but at the time of this project's Preparatory Survey, the Myanmar side explained that the project had stopped. After that, the plan progressed, and the groundbreaking ceremony of the bridge was held in December 2018. When the bridge is completed, a certain number of users are expected to move from this project ferry to the bridge. However, it will still take time to complete the bridge, and the number of users are expected to be limited due to the fact that the bridge is constructed away from the existing ferry route (connected to downtown Yangon), and that it is a large bridge that is difficult to cross on foot or by bicycle without transportation services such as new bus routes.

From the above, this project is highly consistent with the development needs of Myanmar.

3.1.3 Consistency with Japan's ODA Policy

The priority areas of Japan's assistance policy to Myanmar (April 2012) effective at the time of the ex-ante evaluation included, "I. Improvement for the people's livelihood" and "III. Development of infrastructure and related systems necessary for the sustainable economic development." This project was to develop public transportation systems used by many citizens and therefore was consistent with the above policy. At the time of the project, Japan's support to Myanmar was fully resumed, as represented by the resumption of ODA Loan in FY2012, while other development partners also resumed its assistance in response to democratization in 2011. Under such circumstances, both the Government of Japan and the Government of Myanmar needed quick and visible cooperation projects. The project, which targets ferries used by many people, had great significance as visible and quick support by Japan. Furthermore, it was decided before the project that the Dalla jetty, which was damaged by the Cyclone Nargis in 2008, would be reconstructed through JICA's technical cooperation project, "Urgent Project for Rehabilitation of Yangon Port and Main Inland Water Transport," which started in 2009. Thus, this project was formulated with an awareness of the synergies between the two projects. Therefore, this project was consistent with Japanese aid policies at that time.

3.1.4 Appropriateness of the Project Plan and Approach

Despite a lot of floating rubbish, high salinity, and frequent trips made on short routes in a fast-flowing river, the three project ferries are operating continuously every day from 5 am to 9:30 pm in rotation (two vessels operate and one standby at the site), respond quickly to

breakdowns if there are any. As a result, the following effects have been realized. The proper project design has contributed to this, including the number of new ferries to be built, which was decided based on the examination of rotation schedules, and the procurement of spare parts and equipment. It can be said that the project design that fully took into account the actual operations and local conditions contributed greatly to the achievement of the project objective.

In summary, this project has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The planned and actual outputs of the project are shown in Table 1 which shows that outputs have been achieved almost as planned. The difference in gross tonnage is the difference between the approximation and the actual measurement. As a major change, the originally planned main engine-driven generator was changed to diesel generators. The reason for this was that the model of the main engine driven generator, which met the Class NK inspection, was no longer available and there was no time to have another model inspected. Given the high urgency of renewing existing vessels and the fact that such generators were planned for supplementing the solar power generator, it is considered an appropriate change in light of the objective of this project.

With regard to transporting ferries from the shipyard in Japan, it was changed from sailing using their own propulsion to transportation on board by a heavy lift cargo vessel. This was because it was discovered immediately before transportation that this project was applicable to the scope of the STCW Convention,[5] which requires a bilateral agreement to approve the maritime qualifications of a given country for foreign seafarers to board a commercial ship in a given country. As a result, it became impossible for skilled Japanese seafarers, which were indispensable for the operation, to board the ships. It can be said that this change was due to circumstances that were difficult to foresee in advance, and therefore appropriate changes were made by utilizing the residual budget from the bidding.

[5] The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers. Japan and Myanmar have concluded a single-sided commitment that Japan approves Myanmar's maritime qualifications. In similar projects in the past, transportation of ships by self-navigation with Japanese seafarers on board was regarded as a non-profit operation of state-owned vessels, which means outside the scope of the Convention. In this project, the Japanese Ministry of Land, Infrastructure, Transport and Tourism decided that transportation of the project ferries was also regarded as commercial operations to which the Convention applies.

Table 1　Comparison of Planned and Actual Outputs of the Project

	Plan	Actual
<Matters to be borne by the Japanese side>		
Building of the new ferries	- 3 vessels (length overall: 41.35m, 290 tons, passenger capacity: 1,200) - Main engine horsepower: approx. 200kW (270ps) x 2	- 3 vessels (length overall: 41.35m, 310 tons, passenger capacity: 1,200) - Main engine horsepower: 204kW (278ps) x 2
Procurement of the equipment	Tools, Spare parts for preventive maintenance policy (PMP spare parts), De-rusting equipment, Portable pax chairs	- Tools, PMP spare parts, De-rusting equipment, Portable pax chairs - Addition of spare parts using residual budget (main engine assembly and propulsor, 1 unit each)
Transport from the shipyard in Japan	Sail by their own propulsion	Changed to transportation by a heavy lift cargo vessel using residual budget
<Matters to be borne by Myanmar>	1) Conclusion of Banking Arrangement with an authorized foreign exchange bank in Japan, issuance of an authorization to pay, and bearing necessary commissions to the bank 2) Acquisition of licenses and certificates of the Myanmar Government, necessary for building and transporting the New Ferries, e.g. Provisional Certificate of Nationality, and Radio Station License 3) Exemption of the New Ferries and Equipment from customs duties, internal taxes and fiscal levies, and prompt customs clearance 4) Exemption of Japanese nationals from customs duties, internal taxes and fiscal levies for their services in Myanmar 5) The Dalla Dock shall be prepared to accept spare parts and tools for the New Ferries and to be ready to serve the New Ferries as the workshop for them 6) Any other items which are not covered under the Project	All were carried out without delay. The spare parts are stored at the Dalla Dock.

Source: Documents provided by JICA

3.2.2 Project Inputs

3.2.2.1 Project Cost

This project's planned and actual costs are shown in Table 2.

Table 2　Comparison of the Planned and Actual Cost of the Project (Million yen)

	Plan	Actual
Cost at the Japanese side	1,166	1,166
Design and management	49	49
Shipbuilding and equipment (incl. originally planned transportation from the shipyard in Japan by own propulsion)	1,117	999
Additional spare parts	-	16
Additional transportation cost by a heavy lift cargo vessel	-	101
Cost at the Myanmar side	1	unknown

Note: The totals do not match because each item is rounded down.
Source: documents provided by JICA

The cost to be borne by the Myanmar side was to be only for the bank commission and charges. It is assumed that Myanmar's contribution was basically in line with the plan because the cost borne by Japan was almost as planned and that there was no comment from the stakeholders of both countries on problems concerning payment of bank fees or the amount of money borne by the Myanmar side. However, since it was not possible to confirm the actual amount, the project cost has been evaluated by comparing only the cost borne by Japan. The actual cost paid by the Japanese side was 99.8% of the initial plan and therefore was within the plan.

3.2.2.2 Project Period

The project's period was planned for 22 months from March 2013 to December 2014 (counting both the first and last months), but it was completed in 21 months, from March 2013 to November 2014, and therefore was shorter than planned (95% of plan).

The overall period was shortened as the period from the conclusion of the G/A to the detailed design was shortened by one month from 6 months to 5 months of the initial plan (counting both the first and last months). As a result, the shipbuilding contract was concluded in early July, earlier than the planned August 2013, resulting in the earlier completion (handover) in November 2014 than in December 2014 as given in the original plan.

Behind this shortening of the project period was the resumption of Japan's full-fledged cooperation following the democratization as described above. The Preparatory Survey of this project was conducted as a fast-track project. Therefore, before the conclusion of the E/N, JICA and the consultants rigorously discussed scheduling arrangements to shorten the detailed design time as much as possible. As the period from the distribution of the tender documents to the tender cannot be changed, the consultants' document preparation period and procedures within JICA were shortened by the efforts of the parties concerned.

To summarize, this project produced outputs that are generally in line with its plans. Any changes from the original plans are minor and do not affect the project outcome. With regard to project inputs, the project cost was within the plan, and the duration of the project was shortened by approximately one month due to efforts by the Japanese side. Thus, both the project cost and project period were within the plan. Therefore, efficiency of the project is high.

3.3 Effectiveness and Impacts[6] (Rating: ③)

3.3.1 Effectiveness

For effectiveness, the indicators and targets set at the time of planning as the expected effects of this project were examined. Then, both the quantitative effects based on the achievement of operation and effect indicators and the other effects (qualitative effects) were analyzed.

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

As an operation indicator for measuring the operational status of this project, the "percentage of overloaded operation (%)" was measured. In the existing ferries (passenger capacity: 433-742), there were constantly around 1,000 passengers in the morning and evening rush hours at the peak, so at the time of the Preparatory Survey, the percentage of overloaded operation was 10.6%. The passenger capacity increased to 1,200 in the project ferries, and IWT increased the number of operations in the morning rush from the normal 20-minute interval, which was the same as the existing ferries, to a 15-minute interval, realizing four trips per hour, as reduction in traveling time made it possible. As a result, the number of passengers per operation rose to the 500s even during the peak. An interview with the executing agency also confirmed that there has been no overloaded operation. Therefore, this indicator met the target.

Table 3 Percentage of Overloaded Operation (Operation Indicator)

	Baseline	Target	Actual
	2011	2017	January 2019
		3 Years After Completion	4 Years After Completion
Percentage of overloaded operation (%)	10.6%	0%	0%

Source: Documents provided by JICA and IWT

Note: The actual figure is calculated from the record of hourly ticket sales for January 1-15, 2019 provided by IWT.

As effect indicators to measure the effects of the project to improve the safety of the ferry routes, three indicators were examined: the number of operating months, the maintenance and repair cost, and the area of bottom shell change. The last indicator was set as an additional indicator at the time of this evaluation.

Of these, the number of operating months was an indicator that showed the docking period for new ferries was shortened to about one month every other year. The operating period per vessel increased, while existing vessels suffered serious bucklings and damages; and each vessel was unable to operate for about three months each year due to docking (one of four vessels was always docked and the remaining three vessels were in operation). As shown in Table 4, the actual months of operation in FY2017 was 11.1

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

months. The average for the two years in FY2016 and FY2017 was also reviewed and compared, as one dock scheduled for FY2016 was actually carried out in April 2017, and the results were almost the same at 11 months (achievement rate of 96%). The dock period for the new ferries was estimated to be about one month every other year, but in practice, docking is required every year under the regulations of the Department of Marine Administration (DMA). The dock period was about 15 days on average, but in some cases, it took 1 to 1.5 months depending on the year. This does not necessarily indicate the amount of repair work required, as the number of standby days at the dock to wait for the inspector is included in the period.

Table 4　The Number of Operating Months (Effect indicator 1)

	Baseline	Target	Actual			
	2011	2017	2015	2016	2017	2016-2017 average
		3 Years After Completion	1 Year After Completion	2 Years After Completion	3 Years After Completion	
Number of operating months (month/year/ship)	9.4 (285 days)	11.5 (345 days)	11.7 (351 days)	10.9 (328 days)	11.1 (332 days)	11.0 (330 days)

Source: Documents provided by JICA and IWT
Note: The number of operating months is the total number of operating days and the number of standby days at the jetty. The actual figure is counted from April to March of the following year, based on Myanmar's fiscal year.

The comparison of planned and actual maintenance and repair costs is shown in Table 5. In FY2017, the target year, maintenance and repair costs were 25.5 million kyats. Taking into account that the implementation of one of the 2016 regular docks was shifted to FY2017, the average maintenance and repair cost for the three years from FY2015 was also calculated, which was 15.6 million kyats. Although the cost was lower than the baseline based on the actual expenditure of existing vessels, it is 5.2 times higher than the target; and the target was not achieved.

Table 5　Maintenance and Repair Cost (Effect indicator 2)

	Baseline	Target	Actual			
	2011	2017	2015	2016	2017	2015-2017 average
		3 Years After Completion	1 Year After Completion	2 Years After Completion	3 Years After Completion	
Maintenance and repair cost (Million kyats)	21.4	3.0 (4.3 before the revision)	2.4	19.0	25.5	15.6

Source: Documents provided by JICA and IWT
Note: Target is the revised value of the planned target excluding the cost for one existing vessel that had been included as a standby vessel during docking. The actual figure is from April to March of the following year, based on Myanmar's fiscal year.

The reason why the actual cost greatly exceeded the target is that the set target was not very realistic. The target was roughly estimated based on the expenditure of existing vessels in 2011, when the condition was poor. The evaluation considers that it is too low to be a target for ordinary maintenance costs in 2017 since it assumes the cost immediately after delivery when spare parts are hardly required; and it does not take into account the inflation rate. Moreover, the fact that more desirable maintenance is being carried out has also influenced the high cost. For example, in the maintenance of existing vessels, general paint available in the ordinary market was used. Currently, marine paint is used, which is desirable, but expensive; and therefore was not used in existing vessels. Besides, there were the costs of purchasing spare parts, such as purchasing and replacing the DC converter on the main engine control panel (800,000 kyats for a converter) six times in total (four of them in FY2017) due to failures. In contrast, according to IWT, the number of vessel failures has decreased compared to existing vessels. Based on these findings, it can be said that this indicator was not suitable as an indicator for measuring "improvement of safety and reliability of the ferry service."

Regarding the third effect indicator, the "area of the bottom shell changed," the corrosive rupture of the bottom shell of existing ferries had a large impact on the safety of the vessels, and the project procured de-rusting equipment to improve safety. However, no indicator was set during planning to measure the degree of safety improvement by this. Therefore, this indicator was used as an additional indicator.

According to interviews with the IWT and Dalla dock as shown in Table 6, there was no case where the bottom shell of any of the vessels was replaced (as of February 2019). Therefore, this indicator achieved its goal.

Table 6 Area of the Bottom Shell Changed (Effect indicator 3)

	Baseline	Target	Actual		
	2011	2017	2015	2016	2017
		3 Years After Completion	1 Year After Completion	2 Years After Completion	3 Years After Completion
Area of the bottom shell changed (Ratio to the total bottom shell area surface/ year/ship)	A quarter to one third of the total bottom shell	0	0	0	0

Source: Documents provided by JICA and interview of IWT

3.3.1.2 Qualitative Effects (Other Effects)

At the time of the project planning, three qualitative effects were expected: 1. Safe hull and well-prepared safety equipment make entire ferry safe, 2. Stoppage due to sudden breakdown decreases, and reliability of on-time operation becomes higher, and 3. No dark spots, well-outfitted canteen, etc. increase passenger comfort. Among them, 1. has already

been confirmed by the previous section for quantitative effects. 2. is analyzed in the following section for impact. In this section, the degree of improvement in passenger comfort in 3. and the effects of safety measures that were not specified as qualitative effects at the time of planning are analyzed based on the current status of relevant outputs and the results of passenger interviews.

(1) Safety measures

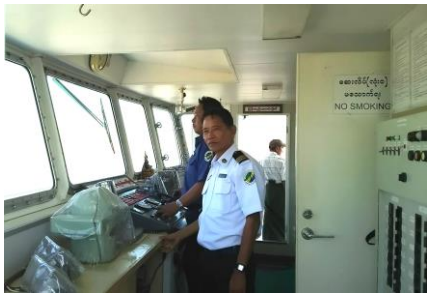
At the time of planning, various issues were identified regarding the safety of the existing ferries, and measures were taken in the specifications of this project. However, all three effect indicators analyzed in the quantitative effects above are indicators of the degree of failure, and the degree of safety improvement in areas not directly related to machine failure has not been evaluated. Since there were no systematic marine safety regulations in Myanmar and the situation of compliance of existing ferries with the regulations was not confirmed in the Preparatory Survey, the status of compliance with these regulations cannot be used as an indicator. Therefore, this evaluation takes up this point as qualitative effects: whether the safety problems pointed out in the old ferries were solved by specifications fitted to the new ferries (Table 7). Specifications corresponding to safety issues pointed out for existing vessels were delivered as planned and were generally maintained and operated at the time of the ex-post evaluation. Thus, it is concluded that this project's safety measures are highly effective.

Table 7 Safety Measures

	Safety issues of old ferries	Countermeasures in new ferries (quantity is per ship)	The situation at the time of ex-post evaluation
1	Steel shipside fender is considerably damaged and the hulls are recessed due to rough maneuvering on berthing and leaving the jetty.	Fender structure and rubber fender are strengthened (15 old tires on each side, hung at shipside by the chain) and training for safe maneuvering.	The fenders were installed as planned. Although the hulls have been recessed and rubbed in some areas, they were repaired. Old tires were added for all three vessels to about 25 tires each side per vessel for the safety of boarding and disembarking vessels.
2	The height difference between the passenger deck and pontoon jetty is sometimes big (max 40 cm) so that transfer of passengers, bikes, wheelchairs are inconvenient or difficult.	The New Ferry will be designed to have a freeboard of 1.40m - 1.50m in way of gangways.	The level difference between the pontoon jetty and the deck is approximately 0 to 30cm depending on the tide level, and bicycles, etc. were boarding and disembarking without problems. Most passengers responded that the level difference improved (passenger interview).
3	In the wheelhouse navigation equipment like radar, GPS or echo sounder is not fitted. Thus, the possibility of operation is limited in heavy fog and heavy rain.	Radar, GPS and echo sounder will be equipped.	All of them were installed as planned, and there are no faults. It was explained that the equipment is used during heavy rain or fog when visibility is too low to operate, but on a day of heavy fog at the time of the ex-post evaluation was dealt with by delaying the start.

4	The diesel generator is stopped in the daytime so that no alternate current electricity is available and no common electric equipment can be used.	Two generators and solar power will be provided.	The generator was changed from the main engine driven model to diesel driven. Both the generator and solar panels were functioning so that electric appliances were used during the daytime.
5	No public addressing system is installed onboard. The means of giving instructions to the passengers is limited.	The new ferry will be fitted with a public addressing system and DVD safety information system.	A total of six TV monitors (two in each vessel) had been exposed to the weather and all failed, so the operable DVD player was also detached and stored. Safety information is conveyed by the onboard broadcast facility.
6	No direct means of communication between the wheelhouse and the engine room.	The new ferry will be fitted with a fixed, reliable direct telephone.	The onboard telephone was functioning. Radio equipment was also in operation.
7	Lifesaving equipment is inadequate despite regulations.	Life jackets and lifebuoys will be provided according to the lifesaving regulation of Japan: buoyant apparatus (22px56), lifejackets 126pc, life rings 11pc	The number of lifejackets was increased to 1,335 (by the consultant). Lifejackets, lifebuoys and life rings were equipped in the main deck, upper deck, and bridge deck.
8	Firefighting equipment is inadequate despite regulations.	Fire pumps (2), hydrants (2 sets) and fire extinguishers (8pc) will be provided according to the firefighting regulations of Japan.	A predetermined number of fire pumps, hydrants, and fire extinguishers were installed in a predetermined place. In some cases, the upper deck pump and the fire extinguisher on the main deck were removed to prevent theft, but they are stored in nearby areas such as the crew room, engine room, etc.

Source: Documents provided by JICA and site inspection of this evaluation



Navigation instruments on the bridge


Lifejacket on the deck

(2) Improvement of passenger comfort

Table 8 shows the current status of outputs related to passenger comfort and the results of passenger interviews.[7] It was confirmed that the comfort of passengers and crews has greatly improved, and satisfaction was high compared with existing vessels, although some facilities were not in use due to failure and other reasons.

[7] The passenger interview was carried out for 33 persons in total in consideration of the balance of age and sex, etc. on the ferry ship during the peak and off-peak times on two weekdays and a Saturday.

Table 8 Improvement of Passenger Comfort

	Comfort issues of old ferries	Countermeasures in new ferries	The situation at the time of ex-post evaluation
1	Two of the four old ferries can only use river water for washing, which may be unhygienic.	A large rainwater collecting tank will be fitted for crew and canteen use.	It was installed as planned and used in the rainy season. At the time of the site visit, which was in the dry season, river water was used for showers, and water transported from the land was used for canteens. Two of the three washing machines (one installed on each ship) were damaged. One shower room is used as a storage room.
2	No heat insulation in the wheelhouse and crew cabin wall and deckhead, thus the interior becomes very hot.	Heat insulation will be fitted for crew comfort.	Lining was fitted, and comfort has greatly improved (crew interviews). All the fans in the crew rooms were out of order, except for two fans.
3	Seats are arranged only on the upper deck and not on the main deck.	Several seats (10 fixed timber benches) will be fitted on the main deck, as priority seats. 1,500 portable plastic chairs and 40 benches on the upper deck will also be fitted.	All 50 wooden benches were fixed on the upper deck to ensure space for the main deck (decision by IWT). The priority seats were in front of the upper deck (for foreign nationals and monks) and were plastic chairs. The main deck was equipped with portable plastic chairs, and there were few standing passengers. However, plastic chairs procured by this project were not used because of their small size, and chairs purchased by IWT are used. Like the existing ferries, passengers have to pay to sit in the plastic chairs on the main deck (50 kyats), but space is larger than the existing ships so that the degree of improvement and satisfaction with the seats were very high (passenger interview).
4	Toilets are dirty and dark, with no water. Some toilets do not have doors.	Discharge from the main engine cooling raw water will be supplied to the toilets. Toilets will be fitted with lights.	There were three toilets for each gender and one was Western-style for each gender and locked for use by foreigners, and the remaining two for each gender were normally used. Some doorknobs have been replaced by faults, but doors, locks, lights, and cleaning with main engine cooling water (river water) were functioning. Both men and women make lines and use them. A hand shower was installed in each toilet, but they had been removed due to failures. The degree of improvement and satisfaction of the toilet is high (passenger interview).
5	Passenger decks are dark.	The generator will supply AC power to ceiling lights.	The ceiling lights were installed and used, and the degree of improvement and satisfaction were very high (passenger interview).
6	Some passengers commented that it would be good to see TV on board.	Two 40” monitor TVs and one DVD player will be installed for safety instruction.	Although all the TVs have failed, in one vessel, a new TV was purchased and installed on the upper deck. However, it was not usually used. There were no complaints that the TV was no longer available because the boarding time is short (passenger interview).
7	Rain comes into the passenger space.	Fore-end and canteens space sides will be fitted with rain shields.	The rain shields were installed as planned, but since they were designed for use only in the priority area and the canteen, ordinary passengers get wet in rainy weather. Some passengers are dissatisfied with this, but others were still satisfied since the installation of walls on the deck may lead to poor stability (passenger interviews).

8	No electricity is available in the daytime and refrigerator cannot be used at the canteen.	Refrigerator, water boiler, microwave oven, and electromagnetic cooker to be used with power supply from solar power or generator.	In addition to refrigerators (several units added by canteen operators), water boilers, and various cooking appliances added by canteen operators are used from the daytime to provide cold beverages, hot coffee, and various dishes. Some microwave ovens and electromagnetic cookers have been stored because operators are not used to them, and only some were used. The degree of improvement and satisfaction of the canteens is high (passenger interview).

Source: Documents provided by JICA, site inspection of this evaluation, and passenger interviews

Canteen

Main deck with ceiling lights on

Toilet

3.3.2 Impacts

3.3.2.1 Intended Impacts

The impacts assumed by this project are “contributing to the improvement of infrastructure for the daily life of Yangon people,” which was set as the overall goal in the ex-ante evaluation. Since no concrete indicators were established during the planning process, this overall goal is defined in this evaluation as “improving the convenience of travel to Yangon for ferry users, especially those living in the Dalla area.” Concretely, the situation before and after the implementation of the project were compared for 1) “Stoppage due to sudden breakdown decreases, and reliability of on-time operation becomes higher,” 2) the reduction of traveling time, and 3) the frequency of use, through passenger and crew interviews and operation records.

(1) Improved reliability of on-time operations

According to IWT, when a failure occurred in existing ferries due to troubles with engines or propulsors, although standby vessels were operating instead, the number of operations was reduced with some trips canceled. In contrast, with the new ferries, there are no longer cases where operations are canceled due to failure. According to the passenger interview, many respondents answered that the credibility of on-time operations has increased (all 23 respondents who have used existing vessels out of 28 interviewees, except five respondents who answered that they “don't know”).

(2) Reduced time for travel

At the time of the ex-ante evaluation, the reduction in navigation time was not assumed. Existing ferries operated 46 trips a day every 30 minutes in the early mornings and nights, and 20 minutes in between these times; and the navigation time was six to eight minutes. In contrast, although the number of operations of the new ferry did not change, the navigation time of the new ferry was about six minutes. For two hours during the morning rush hours, the number of operations increased from the normal 20-minute intervals, which was the same as the existing ferries, to 15-minute intervals, so the congestion during the rush hour was mitigated. Many users (24 out of 25, excluding three people who answered, "don't know," among 28 respondents who have experience using the old vessels) feel that the travel time has been shortened compared to existing vessels (passenger interviews). This was also affected by the fact that the number of jetties on the Dalla side increased from one to two because of the technical assistance project, shortening boarding and disembarking times, particularly during the peak hours.

(3) The frequency of use

As seen in the relevance section, at the time of ex-post evaluation, the total number of passengers has not increased since the time of ex-ante evaluation (as originally assumed). As for the frequency of use of individual passengers, 18 out of 28 persons answered that it was unchanged because they use the ferry for commuting and schooling, or they use it irregularly for some occasions. Some respondents (6 out of 28 persons) reported that they use alternative small boats less and the frequency of using ferries increased due to safety improvement and shortening of the time required (passenger interviews).

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

At the time of the ex-ante evaluation, there was no EIA system in Myanmar, and no EIA procedure was required for vessels. Necessary environmental measures were taken, such as compliance with international conventions on exhaust gas regulations, non-use of asbestos, use of tin-free ship bottom paint (anti-fouling paint to prevent adhesion of moss and shellfish) and introduction of solar power. No adverse environmental and social effects have occurred compared with existing ferries.

The Annex-IV of the International Convention for the Prevention of Pollution from Ships (Prevention of the Emission of Feces and Wastewater) applied to marine vessels navigating open ocean was not applicable to the project ferries because of their short navigational hours, and there were no river drainage regulation standards in Myanmar at

the time of ex-ante evaluation. Therefore, direct discharge outside the vessel was practiced by the existing ferries. However, because the legislation on sewage discharge for river vessels was expected to be promulgated soon, the DMA recommended that sewage holding tank and pump systems be installed to discharge sewage to land, provided that they are utilized when relevant regulations are enforced. According to the water quality test in the Preparatory Survey, although suspended in soil, the water quality of the Yangon River was not particularly polluted according to the environment standard.

At the time of the ex-post evaluation, the applicable law, "the Inland Steam Vessels Law, 2015 (29/2015)" was enacted in 2015, but the rule, which stipulates specific wastewater emission regulations, was submitted to the House of Representatives and has not yet been adopted. As a result, all sewage was discharged directly out of the board in the same way as existing vessels. Although this is not a negative impact caused by this project because the practice does not differ from existing vessels, it is an issue that needs to be considered from the viewpoint of environmental impact.

(2) Resettlement and Land Acquisition

In this project, there were no plans to relocate or acquire lands, nor did they occur. From the viewpoint of gender and disability considerations, facilities that can be used safely and comfortably for women and persons with disabilities are being developed and used, such as the establishment of seats on the main deck, the improvement of toilets (separate for men and women as in existing vessels, and with improved doors, lighting, and cleanliness as shown in Table 8), and the improvement of steps. This is an improvement over existing vessels.

(3) Unintended Positive/Negative Impacts

The project ferries are named "Cherry," and it is widely known to users and neighbouring residents that it is a Japanese ODA project. Each ferry has a nameplate and stickers showing Japanese flags and most respondents (30 out of 34) recognized that the ferry is Japan's cooperation in passenger interviews. The ways they learned this included: from the nameplates and stickers, from media coverage, and heard from people, with almost equal frequency. During the passenger interviews, respondents and surrounding passengers repeatedly expressed their gratitude to Japan. The fact that the ferry fee for Japanese nationals is free of charge whereas the fee for foreign nationals is 4,000 kyats for round trips also shows Myanmar's gratitude for this project. Therefore, it is concluded that this project served as visible cooperation and has had a positive impact on Japanese ODA public relations.

In particular, as a large nameplate was installed on the Dalla jetty developed through

the technical cooperation project, the synergy effect between the two projects is also seen as part of this visibility aspect, in addition to shortening the required travel time, improved safety (by installing fences, safely moving even in bad weather and congestion), improved transportation capability, and improved technical capability of the Dalla dock described later.


Passengers crossing the Dalla jetty


A nameplate installed on the Dalla jetty


A nameplate installed on the main deck

In summary, as for the quantitative effects, the operation indicator "percentage of overloaded operation" achieved the goal, while of the three effect indicators, the "number of operating months" largely achieved the target, and the "area of the bottom shell changed" also achieved the target. Regarding the "maintenance and repair cost," although the actual figure has significantly exceeded its target amount, the target is an estimate based on the expenses of existing vessels that does not take into account the inflation rate, etc., and the number of failures per se has decreased compared to existing vessels. Among the qualitative effects, the "degree of safety issues solved" was judged to be high, as the safety measures taken were generally maintained and operated at the time of the ex-post evaluation. As for "improvement of passenger comfort," the related specifications were generally maintained and operated, with the comfort of passengers and crews greatly improved compared to existing vessels; and it has been confirmed that the level of satisfaction is high. Therefore, it is concluded that the improvement has been achieved. Thus, the overall results of all effect indicators suggest that "recovery and improvement of safety" have been realized by the project.

With regard to impact, the impact of "improved reliability of on-time operations" and "reduced time for travel" has been observed, and the impact of "contributing to the improvement of infrastructure for daily life of Yangon people," which is an overall goal, has emerged from the viewpoint of "convenience of travel." In addition, synergies were observed with the related technical cooperation project in terms of shortening of the time required, safety, transportation capacity, etc. Negative environmental and social impacts have not been identified. As another impact, this project was widely known to users as Japanese cooperation, so it is recognized as visible cooperation of Japan.

This project has largely 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

The project ferries have been consistently operated by the IWT from the planning stage to the ex-post evaluation stage, and the Dalla dock under the IWT was in charge of docking and repairs. The number of IWT staff was 5,309 at the time of the ex-ante evaluation and 2,296 at the time of the ex-post evaluation.[8] The IWT has seven departments and carries out inland water freight transportation, inland water passenger transportation, ferry operation, repair of its own vessels at its own shipyard, and construction of small vessels.

The composition of the crew members of the ferry is as follows: one captain, one steering operator, seven deck staffs, one chief engineer, and two engine officers (12 in total) on each existing ferry, and one captain, two steering operators, seven deck staffs, one chief engineer, and two engine officers (13 in total, excluding cleaners) on each new ferry. Therefore, the number of crew members on new ferries has been increased by one. Thus, the operation and maintenance structure of the project ferry is almost unchanged from the planning stage, and its sustainability is expected to be high.

3.4.2 Technical Aspect of Operation and Maintenance

The captains and the chief engineers of the existing vessels were certified seafarers of inland ships, and the crew members used a special maneuvering system to perform skillful maneuvering on the site where large vessels and river vessels often travel to and from the port of Yangon upstream. Training in maneuvering was carried out at the time of construction of the project ferry, as planned in Japan, and the captains, chief engineers and steering operators who received the training are all currently engaged in the operation of the project ferries. They have also provided technical guidance to other crew members in the form of OJT. Operating manuals provided in English in this project are translated into Myanmar by IWT and posted or stored in the bridge and engine rooms.

Regarding the technical level of the Dalla dock (shipyards) for maintenance of this project's ferries, it was confirmed that it was adequate as the maintenance function of the project ferries at the time of ex-ante evaluation. Although the facilities were very old and not adequate, the technical level of the mechanical engineers was high, and the repair function of the hull and the open maintenance function of the engines were adequate. Although the facilities of Dalla dock remain unchanged at the time of the ex-post evaluation, regular maintenance has been conducted and in the event of failure of the project ferries, problems have been identified and repaired without problems. At the time of regular dock in

[8] As a cost-saving measure for privatization after the ex-ante evaluation, the number of personnel was relocated to the Ministry of Transport and Communications, and the number of activities under the jurisdiction was also reduced. After that, privatization was canceled, and the number of posts at the time of ex-post evaluation was 10,939, of which 2,296 staff were allocated (documents provided by IWT).

October-December 2018, the dry dock was under repair; and therefore, regular maintenance was carried out at another IWT-affiliated Dagon dock in the neighbourhood without any problems.

According to Japanese consultants from this project and the technical cooperation project, the technical capacities of the Dalla dock are sufficient for normal maintenance. Although the technical capacity for large-scale maintenance (special survey) is insufficient due to limited experience, including the overhaul of engines that have not yet been implemented, the technical capabilities have improved due to the technical assistance provided by the above-mentioned technical cooperation project, such as welding. There are branch offices of Yanmar, the main engine manufacturer, in Yangon, and according to the IWT, it is possible to request cooperation from the branch office when necessary in conducting large-scale maintenance.

From the above, it can be said that the technical level needed for operations and maintenance is maintained as planned.

3.4.3 Financial Aspect of Operations and Maintenance

IWT's revenue and expenditure are shown in Table 9. The IWT-wide balance turned profitable as fares were raised from FY2011 for the Dalla ferry and other routes, but it became deficit once again due to declining revenue. Until FY2011, all income was paid to the national treasury, and the necessary expenses were paid from the national treasury, so the deficit did not pose a problem. However, from FY2012, IWT was supposed to achieve self-sustaining income and expenditures and to adopt an independent profit-making system. Following a subsequent change of administration, IWT became a national government corporation again, and the deficit was absorbed by the national treasury, as indicated in the Inland Water Transport Law, 13/2017.

The IWT recognizes that the decline in IWT incomes is due to the shift to land transportation and the decline in the number of IWT routes. However, the importance of inland water transport is pointed out in various transportation master plans, and there is a possibility that the declining trend will be reversed when ports currently under development, such as Mandalay port, are completed.

Table 9 Revenues and Expenditures of IWT (Million kyats)

	FY2010	FY2011	FY2015	FY2016	FY2017
Revenue	7,328	10,982	6,069	4,378	3,563
Expenditure	11,978	10,491	9,750	9,699	10,838
Balance	-4,651	491	-3,680	-5,321	-7,275
Tax amount (30%)	0	147	-	-	-
Balance after-tax	-4,651	344	-	-	-

Source: Preparatory Survey Report and documents provided by IWT

The Dalla ferry's balance of revenues and expenditures remained substantially deficit in FY2010 and earlier, but since raising the 10-kyat boarding fee to 50 kyats from FY2011, it turned a surplus in FY2011. Furthermore, in 2013, the boarding fee was revised to 100 kyats for one way, making it largely profitable, and more than doubled the revenue plan for the new ferry (Table 10). It can be said that it is an appropriate fare setting, considering that the fare of the small boat, which is an alternative means of crossing the river, is 150 kyats, and the fare of the water bus is 200 kyats.

Table 10 IWT Dalla Ferry Project Balances (Million kyats)

	FY2010	FY2011	Plan (as of ex-ante evaluation)	FY2015	FY2016	FY2017
Revenue	122.4	455.3	455.3 (910.5)	1,101.7	1,174.7	1,147.9
Expenditure	239.1	221.5	168.8	283.6	255.6	315.9
Balance	-116.7	233.7	277.2 (741.8)	818.1	919.0	831.9

Note: At the time of ex-ante evaluation, the fare was assumed to be 50 kyats. The amount based on the fare of 100 kyats is shown in parentheses. Expenditures for FY2010 and FY2011 include miscellaneous expenditures such as depreciation and port dues, but these expenses are not included in expenditures from FY2015 onward provided by IWT. For this reason, the amount of the planned expenditure excludes these minor expenses from the amount shown in the Preparatory Survey Report.
Source: Preparatory Survey Report and documents provided by IWT

The expenditures of the Dalla Ferry were approximately 1.5 to 1.9 times the plan calculated in the ex-ante evaluation, and the breakdown is shown in Table 11.

Table 11 Dalla Ferry Expenditures (Million kyats)

	FY2011 (Baseline)	FY2017 Target*1	FY2014 *2	FY2015	FY2016	FY2017
Diesel and engine oil	153.2	146.8	90.1	216.1	173.5	225.1
Crew wages	25.3	18.9	18.8	65.1	63.1	65.4
Maintenance and repair	21.4	3.0	3.9	2.4	19.0	25.5
Material	-	-	2.7	0.4	10.1	18.9
Labour	-	-	1.1	2.0	8.9	6.6
Total	199.8	168. 8	112.8	283.6	255.6	315.9
% of M&R cost to 2011-2012 baseline	100.0%	14.0%	18.0%	11.3%	88.7%	119.2%
% of M&R cost to the target		100.0%	128.6%	80.2%	632.0%	849.3%
% of M&R cost to total expenditure	10.7%	1.8%	3.4%	0.8%	7.4%	8.1%

Note: The above figure does not include depreciation and other minor expenses such as survey fees, registration, port dues, etc. The figure for 2011-2012 and the target figure are based on the Preparatory Survey Report but excluding these items.
*1 Based on the target figure stated in the Preparatory Survey Report but excluding an old vessel, which was included as a standby ferry during regular dock. In reality, the standby ferry during regular dock is not the old Dalla ferry but ferries from other routes. Therefore, the cost for operating the standby ferry is not included in the expenditure under the Dalla dock.
*2 In FY2014-2015, the old vessels operated from April to 16 November 2014 and the new vessels operated from 17 November 2014 to March 2015. The expenditure is only for the new vessels.
Source: The Preparatory Survey Report and documents provided by IWT

As shown in the effectiveness section, even though there was no replacement work for the bottom shell, as there was with the existing vessels, painting costs, spare parts purchasing costs, etc. were higher than originally planned, and there was an increase in maintenance and repair costs. In addition, the unit price of fuel and labour costs rose due to inflation, and the amount of fuel consumed was four gallons per trip (184 gallons for two vessels per day) for new ferries compared to three gallons per trip for existing vessels. As total expenditures have also increased, the ratio of maintenance and repair cost accounted for approximately 7-8% (whereas it was initially planned at about 2%) of the total expenditures, compared to 10-15% for existing ferries. IWT regards the operation and maintenance of Dalla ferries as a top priority, and therefore there was no problem in the increase of such expenditures. However, since the total IWT budget for repair and maintenance is limited, other vessels may be affected.

In this way, the balance of revenues and expenditures of this project has been profitable. As a result of the increase in the fare, revenues have more than doubled than initially planned, and although spending has exceeded the plan, the surplus has been significantly larger than planned. The overall balance of revenue and expenditure of the IWT, which is the administrative body of Dalla ferry, remains in deficit, which was not as planned. But the deficit has been absorbed by the government; and the importance of inland water transport itself is expected to continue in the future. IWT prioritizes the operations and maintenance of the project ferries within the limited budget of the organization. Therefore, it can be said that the financial resources needed for the operations and maintenance of this project are secured.

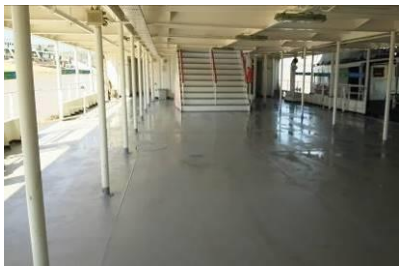
3.4.4 Status of Operation and Maintenance

Three project ferries are operating steadily without missing operations during the planned rotation of standby, rest, and maintenance for one day and operation for two days. All three vessels are well serviced and in good condition. Since 2015, regular docks have been conducted once a year (four times before the ex-post evaluation). The dock period, which took about 3 months for existing vessels, was shortened to around 15 days. The major problems that have occurred thus far are the DC converter failure of the engine room control panel (replacement of about 6 times in total), failure and replacement of the pump impeller (about 6 times in total), repair and replacement of oil seal leakage of the propeller bushing (about 8 times in total), failure and replacement of the starter motor of the engine (2 times in total), etc., but all problems have been identified and dealt with at the time of occurrence. Large-scale docks, including overhauls of main engines, have not been implemented. As confirmed in the effectiveness section, the bottom shell has not corroded, which had been a problem with existing vessels.

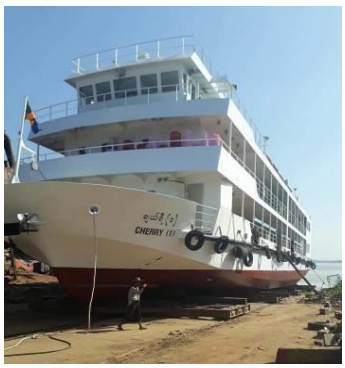
In a few similar projects in the past, since it was difficult to procure spare parts needed for the maintenance of vessels, appropriate maintenance was not carried out, and the vessels deteriorated quickly. Therefore, the project aimed to prolong vessel life by procuring spare parts and introducing preventive maintenance policies (PMPs) that open and maintain machinery and equipment based on planned maintenance programs. As part of the PMPs, it was planned to unload two main engines to the Dalla dock at every other year's periodic dock, exchange them with a spare main engine stored in the Dalla dock, and the unloaded main engine was to be maintained and stored for the replacement of the next main engine. At the time of the ex-post evaluation, however, although regular maintenance had been implemented, this replacement had not been carried out according to the PMP protocol, and spare parts procured by this project were used only in the event of a failure or maintenance. According to IWT, the reason for this was the concern that by opening and maintaining the equipment where no trouble had occurred, would lead to the occurrence of other troubles, and the repair budget would be insufficient.

Immediately after the project was delivered, there was a problem where the main engine stopped because no coolant flowed into the main engine due to clogged rubbish. For all three vessels, measures were taken to replace the seachest strainer with a fine-grained one and to install a seachest trunk. These measures were still effective at the time of the ex-post evaluation, and no problems have occurred.

The de-rusting equipment procured by this project was appropriately used in Dalla dock for maintenance of not only this project ferries, but also some other vessels. Among them, the high-pressure water blasting machine was sent to the Rakhine State for the maintenance of used vessels provided by the Ministry of Foreign Affairs of Japan, and therefore, it was impossible to confirm the actual equipment in this evaluation.



The main deck on the standby day
It is cleaned carefully



Dock in December 2018
(photo provided by IWT)

Sandblasting machine

In this way, the operational and maintenance status of this project was as planned, and the present status of the ferries was good and they have been carefully maintained. Although the maintenance schedules differed from the planned schedules, they were regularly maintained;

and even in the event of a failure, they have been repaired appropriately by utilizing spare parts procured by this project or purchased by IWT.

From the above, 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.

【Box 1. Factors promoting high ownership】

In this project, the careful operation and maintenance of ferries have led to the achievement of effectiveness and high sustainability. Operation and maintenance problems are common in cooperation in the water transport sector in general, but the ownership of the executing agency of this project is very high and these problems have not occurred. The following points are considered to be the promoting factors.

1) The IWT has positioned this route as the most important route even before the implementation of the project. 2) There is continuity of key persons in both the upper-levels of the organization and in the field. The IWT General Manager, Deputy General Manager of the Engineering Department, and other executives have been involved in this project since the beginning. In the field, there are nine training participants, including captains and chief engineers, who remain in the operations of the ferries. 3) The physical and psychological distances between Yangon's IWT headquarters and Pansodan jetty are close, with the captains frequently visiting IWT headquarters. The latter two points are presumed to have been very important because when the ferry fails and spare parts need to be replaced, the permit of the Deputy General Manager in headquarters is necessary. Through the 2016 Grant Aid for Economic and Social Development Programme, Japan has provided three ferries to the Rakhine State, which are also operated and maintained by IWT. Therefore, it may be possible to verify this point by comparing the results of this evaluation with those of the Rakhine project in the future.

4) Dalla dock was established in 1852 and has more than 150 years of history,[9] At that time, they were more technologically advanced than neighboring countries, and there was a certain accumulation of skills and experiences. This is believed to have contributed to the appropriate maintenance of this project. 5) IWT is also one of the counterpart agencies of the technical cooperation project preceding this project, and IWT had experience in working with JICA experts. The project also provided welder training for Dalla dock engineers. It is possible that such training and capacity building through daily activities also contributed indirectly to the smooth implementation of this project.

[9] Source: IWT website. http://www.iwt.gov.mm/en/dalla-dockyard (Accessed on July 9, 2019)

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to improve the safety and reliability of the ferry service crossing the river by replacing existing unsafe old ferries in Yangon with new ferries, thereby contributing to the improvement of infrastructure in the daily life of the Yangon people especially in the Dalla area where many lower income people live. As the project is consistent with Myanmar's development policy, development needs, and Japan's assistance policy, the relevance of the project was high. The project cost was within the plan and the project periods were shortened by approximately one month. Therefore, the efficiency of the project was high. Operation and effect indicators were generally achieved except for one indicator. Although the "maintenance and repair cost" has not been achieved, the basis for the target set at the time of planning was insufficient, and the number of breakdowns per se has decreased compared to existing vessels. All of the safety issues pointed out for existing vessels have been solved, and passenger comfort has been improved. By looking at the overall results of all the effect indicators, it can be said that "recovery and maintenance of safety" have been achieved. From the viewpoint of improving mobility convenience, the impacts are emerging, and synergies with a technical cooperation project have also been observed. Based on the above, the effects of this project were largely as planned, and the effectiveness and impacts of the project were high. Considering that this project's balance of payments is in surplus and the operation and maintenance of ferries are carefully managed, no major problems have been observed in the institutional/organizational, technical, financial aspects and current status of the operation and maintenance system. 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

<u>Further strengthening the maintenance of the ferries</u>

While the project ferries are maintained well, the planned special survey for overhauling has not been conducted partly due to budget constraints. Since this kind of special survey is conducted every five years in general, IWT is advised to conduct special surveys within 2019, or as early as possible. In doing so, it is desirable to contact the main engine suppliers and obtain technical backups, as is usually done in overhauls in Japan. IWT should also refer to the Scheduled Maintenance Plan of PMP (compiled by Nakatani Shipbuilding in July 2014) in other areas of regular maintenance. This will help maintain the vessels' good condition for a longer time.

There are spare parts not included in the project, or those that were included, but already finished. Although some of these parts are expensive, IWT has already learned about the typical

troubles related to these vessels based on four years of operation; and therefore should be able to identify which parts tend to have problems. For these spare parts, it might be a good idea to reduce expenses by purchasing them in bulk or getting multiple quotes.

Discussions with concerned agencies for the use of sewage water discharge

The sewage water discharge facilities, such as the sewage holding tank and discharging pump, are currently not used. This is because the related rule on river water conservation has not been enacted, and therefore, there is no land facility for sewage water. Although the direct discharge of sewage into the river is the same practice as the existing ferries, the sewage water discharge facilities should be used so that the impact on the environment is reduced over the medium term. IWT is ready to utilize these facilities once the rule is enacted and land facilities are available. However, the provision of land facilities is not IWT's responsibility and it might be under the jurisdiction of the Yangon City Development Committee (YCDC) or other organizations, as confirmed by DMA. To this end, IWT should begin discussions with related agencies, including YCDC and DMA, about the development of land facilities in the near future so that the environmental impact of sewage discharge is reduced using the sewage tank provided through this project.

4.2.2 Recommendations to JICA

Follow-up of consultations between IWT and related organizations for the utilization of sewage tank

JICA Myanmar office should follow up on the above-mentioned consultations on wastewater discharge measures among stakeholders and provide advice to IWT as needed, taking advantage of the knowledge and experience of the ongoing sewerage system improvement project (ODA Loan). Furthermore, after the enforcement of sewage discharge regulations, similar measures will be required for vessels other than the project ferries, and technical knowledge and experience will be required to select and develop treatment methods for sewage collected on land. Therefore, it is also possible to consider cooperating with YCDC or other relevant institutions on wastewater discharge measures by inland water transport.

4.3 Lessons Learned

Better indicator setting for measuring the decrease in breakdowns

The maintenance and repair cost was not a suitable indicator to measure the decrease in breakdowns or the achievement of the project objective, "to improve the safety and reliability of the ferry." Although the target was not met, the number of breakdown cases was less than the existing vessels, indicating that the objective was indeed achieved. The target was not met because 1) better but more expensive maintenance was done, such as the use of marine paint,

compared to the existing vessels, 2) inflation was not calculated in the target estimation, etc. To measure the decrease in breakdowns, indicators that are more directly related should be considered, such as the number of failure cases and the cost of repairs (excluding regular and preventive maintenance).

More realistic estimation of maintenance and repair cost

When it is necessary to use the maintenance and repair cost as an indicator in some cases (for example, to measure the cost reduction as an output), the consultant should discuss in detail with the executing agency during the preparatory survey about maintenance policy and see if it is possible to set a realistic target that enables proper comparison in ex-post evaluations. When setting target values, it should consider not only the record of existing facilities, but also specifications and the required maintenance of the planned facility. It may be difficult to make a detailed estimate within a limited period, but this point is also important because some executing agencies may not be able to bear the cost if it significantly exceeds the original plan.

Selection of equipment relevant to the local situation and needs

There were some broken or unused equipment procured through the project, although they were accessories and therefore did not affect the achievement of the project objective. For example, all six TV monitors were broken. Passenger chairs were too small and replaced by new chairs by IWT. Some equipment for the canteen such as the microwave oven and electromagnetic cooker was not used because the canteen staff was not familiar with these items.

As for the TV, the possibility of breakdowns can be foreseen, as the project ferry does not have much wall space in the main deck and upper deck. Since the traveling time of the ferry is only six minutes, the need for TV as onboard entertainment is questionable, as indicated in the passenger interviews. From the standpoint of safety and security, the public address system was functioning. So, if there is a need to show a safety video program to passengers, it might be better to place the TV in the passenger terminal. Concerning the passenger chair, their specification or size might have been decided simply following the example of the old ferries. However, they were replaced by IWT with bigger chairs because they were too small and due to the possibility of passengers falling from the lack of balance. If the Project examined the size of the chair during the design stage, taking into consideration that the deck space was widened in the new ferry and the aim was to improve passenger comfort, this problem could have been avoided. In addition, equipment for the canteen should be equipment needed only by the staff since items that are new and unfamiliar tend not to be used. Therefore, when designing similar projects, it should be noted that the inclusion and specification of accessories should be decided based on a careful examination of the local needs and situation.