Republic of Maldives

Ex-Post Evaluation of Japanese ODA Loan "Maldives Tsunami Reconstruction Project"

External Evaluator: Akemi Serizawa Sanshu Engineering Consultant

0. Summary

The objective of the project was to provide efficient transportation and reliable sewerage services by reconstructing the harbours in eight islands and sewerage systems in three islands in Maldives damaged by the tsunami caused by the Indian Ocean earthquake in December 2004, thereby contributing to the improvement of the living conditions of the affected people and to the recovery of the economic conditions of the country.

Relevance of this project is high, as it has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Efficiency is fair, as the outputs were produced as planned and the project cost was lower than planned, but the project period was significantly longer than planned. Effectiveness is high as the expected outcomes were realized. The harbours are fully utilized as expected because all commodities have been delivered to the islands through them and the people live the normal lives using these commodities, and the number of vessels using the project target harbours is likely to have increased along with the increase of the number of registered vessels per atoll to which the project target harbours belong. Although BOD data¹ did not exist at the time of ex-post evaluation, the sewerage service is also likely to have been provided as expected because BOD5 before treatment was lower than anticipated and that after treatment was much better than the target value at the defect liability inspection in 2011, and the sewerage system is functioning without major problems and the users are satisfied. The effect indicators of the sewerage (population treated, number of connections and percentage of population treated) have achieved the target. Regarding impacts, the living conditions of the people in the islands have been improved compared to those before the tsunami as the commodities available in the islands have increased in terms of number and variety, access to the social facilities such as health centres and schools has improved, and the hygiene and the quality of ground and seawater have improved according to the beneficiary surveys. In total, effectiveness and impact of the project are high. Regarding sustainability, there are no major problems in institutional aspects as the roles of each organization are established, while the operation and maintenance organizations at ex-post evaluation are different from the plan due to the

¹ Biochemical Oxygen Demand (BOD) is an indicator to measure the degree of water pollution from organic substances. Collected water is kept in a sealed glass bottle for five days (=BOD5) at 20 degrees Celsius, and quantity of oxygen required to discompose the organic substances is measured. (Source: Yokohama Environmental creation station website)

changes of the national administration structures and government policies. Some minor problems have been observed in terms of technical and financial aspects. Therefore the sustainability of the project effects is fair.

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

1. Project Description

1.1 Background

Maldives suffered an enormous damage due to the tsunami caused by the Indian Ocean earthquake (also known as the Sumatra-Andaman earthquake) on 26 December 2004. The harbours of about 25% of the inhabited islands were destructed, and the damaged septic tanks caused contamination of groundwater. The government of Maldives formulated the National Recovery and Reconstruction Plan, and JICA implemented this project to support the reconstruction of harbours and sewerage systems, which had not had sufficient funding from donors.



Project location (Maldives) (Source: Ministry of Foreign Affairs, Japan)



Part of Malé Northern Quay Wall, rehabilitated by the project

1.2 Project Outline

The objective of the project was to provide efficient transportation and reliable sewerage services by reconstructing the harbours in eight islands and sewerage systems in three islands damaged by the tsunami caused by the Indian Ocean earthquake in December 2004, thereby contributing to the improvement of the living conditions of the affected people and the economic conditions of Maldives. The location of the project sites is shown in Figure 1.

| Harbours | Funadhoo (Shaviyani Atoll) |
|-----------------------|---|
| (eight project sites) | Maafushi (Kaafu Atoll) |
| | Replaced by Ukulhas (Alif Alif Atoll) after the project started |
| | Malé northern quay wall |
| | Dhiyamigili (Thaa Atoll) |
| | Isdhoo (Laamu Atoll) |
| | Isdhoo-Kalaidhoo (Laamu Atoll) |
| | Fonadhoo (Laamu Atoll) |
| | Dhaandhoo (Gaafu Alifu Atoll) |
| Sewerage | Funadhoo (Shaviyani Atoll) |
| (three project sites) | Eydhafushi (Baa Atoll) |
| | Muli (Meemu Atoll) |



Figure 1. Project sites (Source: JICA documents)

| Loan Approved Amount/ Disbursed Amount | 2,733 million yen /2,616 million yen |
|--|---|
| Exchange of Notes Date/ Loan | June 2006 / July 2006 |
| Agreement Signing Date | |
| Terms and Conditions | Harbours: |
| | Interest rate: 0.8%, |
| | Repayment Period: 30 years (Grace Period 10 years), |
| | Conditions for procurement: General Untied |
| | Sewerage: |
| | Interest rate: 0.75%, |
| | Repayment Period: 40 years (Grace Period 10 years), |
| | Conditions for procurement: General Untied |
| | Consulting services: |
| | Interest rate: 0.8%, |
| | Repayment Period: 30 years (Grace Period 10 years), |
| | Conditions for procurement: General Untied |
| | Department of External Resources, Ministry of Foreign |
| Borrower / Executing Agencies | Affairs |
| borrower / Excenting Ageneres | Ministry of Construction and Public Infrastructure ² |
| | Ministry of Environment, Energy and Water ³ |
| | |
| Final Disbursement Date | October 2012 |
| Final Disbursement Date Main Contractor (Over 1 billion yen) | October 2012 MT Hojgaard A/S (Denmark) |
| Final Disbursement Date Main Contractor (Over 1 billion yen) Main Consultant (Over 100 | October 2012 MT Hojgaard A/S (Denmark) Yachiyo Engineering Co., Ltd. (Japan) / Oriental Consultants |
| Final Disbursement Date Main Contractor (Over 1 billion yen) Main Consultant (Over 100 million yen) | October 2012 MT Hojgaard A/S (Denmark) Yachiyo Engineering Co., Ltd. (Japan) / Oriental Consultants Co., Ltd. (Japan) |
| Final Disbursement Date Main Contractor (Over 1 billion yen) Main Consultant (Over 100 million yen) Feasibility Studies, etc. | October 2012 MT Hojgaard A/S (Denmark) Yachiyo Engineering Co., Ltd. (Japan) / Oriental Consultants Co., Ltd. (Japan) Joint Needs Assessment by World Bank-Asian Development |
| Final Disbursement Date Main Contractor (Over 1 billion yen) Main Consultant (Over 100 million yen) Feasibility Studies, etc. | October 2012 MT Hojgaard A/S (Denmark) Yachiyo Engineering Co., Ltd. (Japan) / Oriental Consultants Co., Ltd. (Japan) Joint Needs Assessment by World Bank-Asian Development Bank-United Nations on Tsunami Impact and Recovery |
| Final Disbursement Date Main Contractor (Over 1 billion yen) Main Consultant (Over 100 million yen) Feasibility Studies, etc. | October 2012 MT Hojgaard A/S (Denmark) Yachiyo Engineering Co., Ltd. (Japan) / Oriental Consultants Co., Ltd. (Japan) Joint Needs Assessment by World Bank-Asian Development Bank-United Nations on Tsunami Impact and Recovery (2005) (JICA also participated) |
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| Final Disbursement Date Main Contractor (Over 1 billion yen) Main Consultant (Over 100 million yen) Feasibility Studies, etc. | October 2012 MT Hojgaard A/S (Denmark) Yachiyo Engineering Co., Ltd. (Japan) / Oriental Consultants Co., Ltd. (Japan) Joint Needs Assessment by World Bank-Asian Development Bank-United Nations on Tsunami Impact and Recovery (2005) (JICA also participated) JICA Study on the Recovery, Rehabilitation, and Development of Islands in the Maldives (2005) JICA Special Assistance for Project Formation (SAPROF) for projects for recovery from Tsunami (2005) |
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| Final Disbursement Date Main Contractor (Over 1 billion yen) Main Consultant (Over 100 million yen) Feasibility Studies, etc. Related Projects | October 2012 MT Hojgaard A/S (Denmark) Yachiyo Engineering Co., Ltd. (Japan) / Oriental Consultants Co., Ltd. (Japan) Joint Needs Assessment by World Bank-Asian Development Bank-United Nations on Tsunami Impact and Recovery (2005) (JICA also participated) JICA Study on the Recovery, Rehabilitation, and Development of Islands in the Maldives (2005) JICA Special Assistance for Project Formation (SAPROF) for projects for recovery from Tsunami (2005) JICA Technical Cooperation Projects: • Study on the Recovery, Rehabilitation, and Development of Islands in the Maldives (March 2005) • Sewerage and Groundwater Management Project (January2009 – December 2010) JICA Grant Aid Projects: • Non-project Grant Aid (January 2005) |

 ² Ministry of Construction and Public Infrastructure (until November 2008) → Ministry of Housing, Transport and Environment (November 2008 – July 2010) → Ministry of Housing and Environment (July 2010 – May 2012) → Ministry of Housing and Infrastructure (May 2012 -)
 ³ Ministry of Environment, Energy and Water (until November 2008) → Ministry of Housing, Transport and Environment (November 2008 – July 2010) → Ministry of Housing and Environment (July 2010 – May 2012) → Ministry of Environment and Energy (May 2012 -)

| • World Bank: Cash grant aid for people affected by Tsunami |
|---|
| and assistance for the recovery of education sector (March |
| 2005) |
| • World Bank: Assistance for education and health sectors |
| (2006) |
| • Asian Development Bank: Budget support and assistance |
| for recovery of infrastructure (March 2005) |

2. Outline of the Evaluation Study

2.1 External Evaluator

Akemi Serizawa, Sanshu Engineering Consultant

2.2 Duration of Evaluation Study

Duration of the Study: July 2014 - May 2015

Duration of the Field Study: September 13-27, 2014, February 7-21, 2015

2.3 Constraints during the Evaluation Study

Due to limited time of the field study, the evaluator visited nine project sites among eleven. They were six harbour sites (Malé, Dhaandhoo, Isdhoo, Isdhoo-Kalaidhoo, Fonadhoo, Funadhoo) and three sewerage sites (Eydhafushi, Funadhoo, Muli).

3. Results of the Evaluation (Overall Rating: B⁴)

3.1 Relevance (Rating: ³⁵)

3.1.1 Relevance to the Development Plan of Maldives

Following the Joint Needs Assessment by the World Bank, Asian Development Bank (ADB) and the United Nations on Tsunami Impact and Recovery (January 2005) on the damages by the tsunami caused by the Indian Ocean earthquake on 26 December 2004, the Government of Maldives developed the National Recovery and Reconstruction Plan in March 2005. By December 2005, bilateral and multilateral donors had offered 262 million US dollars in total out of 375 million needed for this Plan. The transport sector including harbours had a shortage of 41 million US dollars out of 73 million required. Similarly, the water and sanitation sector including sewerage had a shortage 20 million out of 45 million US dollars required. JICA decided to implement this ODA loan project to fill this gap in funding.

There are about 1,190 islands in Maldives, among which 199 are inhabited by about 290 thousand people in total. According to the Article 23 of the National Constitution of 2008, equitable access to transport and access to sewerage systems of adequate standards in all inhabited islands are among the basic rights of the Maldivian citizens.

⁴ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁵ ③: High, ② Fair, ① Low

The Seventh National Development Plan (2006-2010) mentioned not only about the reconstruction from the tsunami damages, but also about the development needs of harbours as Maldives relied on maritime transport and also those of sewerage systems because inappropriately treated wastewater caused pollution of groundwater and seawater. The Seventh National Development Plan was replaced by the Strategic Action Plan (2009-2013) in the midway due to the change of government, which also prioritized the improvement of domestic transport networks including maritime transport as well as water supply and sewerage systems.

After the presidential elections in November 2013 and the parliamentary elections in March 2014, there is no national development plans. The manifest of the current leading party in the presidential elections shows the directions of national development and promises that all inhabited islands would have appropriate harbours which allow access to facilities such as airports, health centres and schools. It also prioritizes the improvement of sewerage systems.

The Maritime Transport Master Plan which was developed in collaboration with ADB and approved by the Government in November 2013 aims to improve ferry networks and harbours. Concerning sewerage services, there are no laws or guidelines to regulate operation and maintenance. The Ministry of Environment and Energy (MEE) is drafting the Water and Sewerage Act, which is to be approved by the Parliament in 2015. MEE plans to install sewerage systems in 45 islands between 2013 and 2015 in addition to the 30 islands that had sewerage systems as of 2012 out of 199 inhabited islands in Maldives.

As mentioned above, at appraisal and at ex-post evaluation, the implementation of the project conforms to the development policies of Maldives.

3.1.2 Relevance to the Development Needs of Maldives

Harbours are very basic infrastructure in the Maldivian islands as all people and commodities come and go through them. Fishery, which is the only industry in many islands, is not possible to survive without harbours. Rehabilitation of the tsunami-damaged harbours was urgently needed. Sewerage systems did not exist before the tsunami in 2004 in most islands, and inappropriately treated wastewater by individual septic tanks was discharged to the ground or to the sea with a risk of pollution of groundwater and seawater. The Government of Maldives decided to introduce sewerage systems in selected islands after the septic tanks were damaged by the tsunami. The selection criteria for this JICA project sites were as follows:

- Damaged by the tsunami.
- Included in the Recovery and Reconstruction Plan of the Government, which was based on the Joint Needs Assessment.

- Not supported by other donors.
- No serious negative impacts on the environment were foreseen.
- The affected people strongly demanded the recovery/reconstruction of the damaged facilities.
- The population⁶ of the island was more than 500.

Duplication of assistance was avoided by the coordination between the Government of Maldives and the donors in selection of the sites to support. While the JICA project was originally to support eleven harbours sites and eight sewerage sites at the request of the Government, the target sites were reduced to eight harbours and three sewerage sites after the assessment of damage⁷ and also considering the Government's limited capacity of handling ODA loan project in the deteriorated economic situations after the tsunami.

At the ex-post evaluation, needs for the improvement of harbours and sewerage systems still exist because they continue to be the basic infrastructure for the islands. Only about a half of the inhabited islands has proper harbours. The ferry services in the areas far from Malé do not have regular timetables and the fares are expensive. Malé harbours are always congested as 90% of the cargoes delivered to other islands are handled there⁸. Only 30 among 199 inhabited islands had sewerage systems as of 2012. In other islands without sewerage systems, the groundwater is contaminated by inappropriately treated wastewater coming from septic tanks, and availability of safe drinking water is limited⁹.

| • ropulation statistics of the | project target istands | | |
|--------------------------------|------------------------|---------|---------|
| Island | 2000 | 2006 | 2014 |
| Malé | 74,069 | 103,693 | 153,379 |
| Ukulhas | 535 | 615 | 918 |
| Dhiyamigili | 484 | 452 | 562 |
| Isdhoo/ Isdhoo-Kalaidhoo | 1,432 | 1,559 | 1,411 |
| Fonadhoo | 1,740 | 1,762 | 2,203 |
| Dhaandhoo | 1,150 | 1,113 | 1,106 |
| Funadhoo | 799 | 1,599 | 2,099 |
| Eydhafushi | No data | 2,409 | 2,626 |
| Muli | No data | 746 | 862 |

⁶ Population statistics of the project target islands

(Source: Year 2000: questionnaire response from the Ministry of Housing and Infrastructure. Year 2006 and 2014: Population and Housing Census 2014, Preliminary Draft 13 Nov. 2014, by the National Bureau of Statistics)

⁷ These harbor sites were originally to be covered by this Project but were finally excluded. They were all rehabilitated by other funds:

• Makunudhoo: Being reconstructed by the fund of European Investment Bank.

• Lhohi: Reconstruction was completed in 2008 by the fund of the Maldivian Government.

• Hirilandhoo: Reconstruction was completed in 2014 by the OPEC Fund for International Development (OFID).

• Maafushi got fund of the Maldivian Government in 2007 and reconstruction was completed in 2010. Ukulhas was originally to be supported by USAID, but excluded later because it needed more budget than planned. The JICA project decided to support Ukulhas instead of Maafushi because Ukulhas met the criteria of the site selection and other funding was not available.

⁸ ADB Interim Country Partnership Strategy: Maldives, 2014–2015

⁹ Report of Ministry of Environment and Energy presented at Fifth South Asian Conference on Sanitation in Nepal, 2013

From the above, at appraisal, there was a necessity to urgently rehabilitate the facilities damaged by the tsunami as they were basic infrastructure in the target islands. At ex-post evaluation, there is still a need to improve these facilities. Therefore, this project is in line with the development needs of Maldives at the time of appraisal and ex-post evaluation.



Dhaandhoo harbour



Muli wastewater treatment plant

3.1.3 Relevance to Japan's ODA Policy

At the time of appraisal, JICA's Medium-Term Strategy for Overseas Economic Cooperation Operations (2005) prioritized assistance to the worldwide issues and peace building including mid- and long term support to recovery and reconstruction from disasters as well as prevention. Japan's Country Assistance Policy for Maldives at that time prioritized basic social infrastructure and social development including health, education and community development, considering the development needs and the potential benefits. The project conformed to these assistance policies at appraisal.

3.1.4 Relevance of project planning and approach

Relevance of indicators

As explained in the section of Effectiveness, "the number of vessel arrival per week" was selected as an operational indicator for the harbours. However, it was not possible to measure it because such data had not been collected. This section discusses the relevance of selection of such indicator which is difficult to collect especially in emergency relief projects after natural disasters.

According to JICA documents, the baseline numbers of "vessel arrival per week" of Funadhoo, Maafushi, and Fonadhoo harbours were obtained from the Island Chiefs. As there is no system to record vessel arrival in Maldives islands, the obtained figures are likely to have been just assumptions. The target numbers of vessel arrival per week after the project completion were calculated by the SAPROF team based on expected economic growth and other factors. According to JICA documents at appraisal, there was an opinion in the Government of Japan that the project target harbours must have been reduced only to these three because of lack of the data, which concerned the capacity of the Government of Maldives to monitor the indicators during the post-tsunami reconstruction. JICA argued that it was unrealistic to agree with all target Island Development Committees (headed by the Island Chiefs) about the indicators and targets because they were all busy for recovery/reconstruction after the tsunami in the emergency situation. The Government of Maldives and JICA agreed on the target values of vessel arrival per week of these three harbours. However, JICA's documents at appraisal also showed the target values of other harbours, the reasons of the agreement of these target values are not clear. The Island Development Committers were replaced by the Island Councils in 2011, and the institutional memory about the agreement on the project indicators does not remain in the Island Councils at the time of ex-post evaluation. Also, current staff members of the Ministry of Housing and Infrastructure (MHI) do not know the process how the project indicators were agreed. Setting such an indicator could have been inappropriate, as it is not realistic for such small and basic harbours to record the number of vessel arrival as vessels come and go anytime, and there is no system, procedure or person to record it.

The World Bank and ADB set only output indicators such as the length of harbours rehabilitated or the number of classrooms constructed to measure the outcomes of projects to support recovery from tsunami damages. Since the JICA project was also emergency assistance for the quick recovery of normal life of the affected people, this project also should have used output indicators but not indicators without actual data and therefore monitoring of which was unrealistic. All the same, the project was still relevant despite this indicator problem because they did not hinder the achievement of expected outcomes of the project.

While there was a problem in setting indicators to measure Effectiveness, this project has been highly relevant with the Maldives' development plan and development needs, as well as with Japan's ODA policies. Therefore its relevance is high.

3.2 Efficiency (Rating: 2)

3.2.1 Project Outputs

The outputs of the project (plan and actual) are shown in Table 1 and 2. Although there are some discrepancies between the original plan and actual outputs after the detailed design, the actual outputs are more or less same as the plan. According to the project consultants, the harbours were upgraded compared to those before the tsunami. Better

materials were used to reduce the maintenance cost and frequency, and the size of the quay walls were widened in some sites where the geographical and financial conditions allowed so that as many vessels as possible could moor. The replacement of one harbour site (from Maafushi to Ukulhas) was reasonable as Ukulhas did not have other source of funding and met the selection criteria of the JICA project.

The outputs of the sewerage systems were also almost same as the plan. According to the project consultants, the original system consisted of individual septic tanks, sewer pipes connecting septic tanks and the treatment plants, and treatment plants from where treated wastewater was to be discharged to the ground. The sewer pipes were combination of "gravity system" by which wastewater is carried by gravity and "force feed pumping system" which uses pumps where the pitch is not steep enough. The actual design falls basically in the same system as the plan, but there are no individual septic tanks, and wastewater is directly carried by the sewer pipes to the treatment plant, and treated in aeration tanks in which pollutants are decomposed by air blown by electric power and then discharged to the sea. At appraisal, the Ministry of Environment, Energy and Water Resources was against the system with septic tanks because sludge treatment and securing space at each house were difficult and the wastewater from septic tanks would contaminate the groundwater. The change of sewerage systems was based on the request of the Government of Maldives, and technically and environmentally appropriate.

| 14010 1 | | (piùn uno uotaut) |
|----------------------|-------------------------------------|---|
| Harbours | Original Scope | Actual Scope |
| | (At time of L/A) | |
| Funadhoo | Quay wall (370m), Breakwater | Same as the plan |
| | (120m), Seawall (350m), Pavement | Quay wall (370m), Breakwater (A1 |
| Width of quay wall | and navigation aid (110m), Dredging | 112m, A2 305m), Seawall, Pavement |
| before Tsunami | (18,000 m ³) | and navigation aid, Dredging (Basin |
| 370m | | 40,800 m ³ , Channel 26,108 m ³) |
| Maafushi | Quay wall (150m), Breakwater (150 | Replaced by Ukulhas |
| Width of quay wall | m), Seawall (240m), Pavement and | |
| before Tsunami | navigation aid (160m), Dredging | |
| 100m | (21,000 m ³) | |
| Ukulhas | (N/A) | Breakwater, Pavement and navigation |
| | | aid, Dredging (Basin 2,899 m ³ , |
| No repair of quay | | Channel 1,753 m ³) |
| wall | | , , , |
| Malé | Quay wall (110m) | Same as the plan |
| Quay wall was partly | | Quay wall (110m), Pavement and |
| repaired by this | | navigation aid |
| Project | | |
| Dhiyamigili | Quay wall (158m), Breakwater (300 | Same as the plan |
| Width of quay wall | m), Seawall (170m), Pavement and | Quay wall (200m), Breakwater (A1 |
| before Tsunami | navigation aid (150m), Dredging | 70m, A2 135m), Pavement and |
| 158m | (17,000 m ³) | navigation aid, Dredging (Basin |
| | | 29,884 m ³ , Channel 10,378 m ³) |
| Isdhoo | Quay wall (14m), Pavement and | Same as the plan |
| Width of quay wall | navigation aid (50m), Dredging | Quay wall (140m), Breakwater |
| before Tsunami | (2,900 m ³) | (132m), Seawall, Pavement and |
| 150m | | navigation aid, Dredging (Basin |

Table 1. Comparison of Outputs: harbours (plan and actual)

| | | 21,270 m ³ , Channel 1,700 m ³) |
|--|---|--|
| Isdhoo-Kalaidhoo Width of quay wall | Quay wall (19m), Pavement and navigation aid (110m), Dredging | Same as the plan Ouay wall (100m), Breakwater (A2 |
| before Tsunami 93m | (4,250 m ³) | 80m), Seawall, Pavement and |
| | | navigation aid, Dredging (Basin |
| | | 8,910 m ³ , Channel 6,830 m ³) |
| Fonadhoo | Quay wall (220m), Breakwater (70 | Same as the plan |
| Width of quay wall | m), Seawall (172m), Pavement and | Quay wall (267m), Breakwater (A1 |
| before Tsunami | navigation aid (301m), Dredging | 57m, A2 193m, Repair 928 m ³), |
| 170m | (21,500 m ³) | Seawall, Pavement and navigation |
| | | aid, Dredging (Basin 53,901 m ³ , |
| | | Channel 25,471 m ³) |
| Dhaandhoo | Quay wall (150m), Breakwater (130 | Same as the plan |
| Width of quay wall | m), Pavement and navigation aid | Quay wall (223m), Breakwater (A2 |
| before Tsunami | (100m), Dredging (12,000 m ³) | 216m), Seawall, Pavement and |
| 150m | | navigation aid, Dredging (Basin |
| | | 38,721 m ³ , Channel 5,012 m ³) |

(Source: JICA documents)

| 14 | ere 2. comparison of outputs. sem | eruge (prun und detdui) |
|------------|---------------------------------------|--------------------------------------|
| Island | Original scope | Actual scope |
| | (at the time of L/A) | |
| Funadhoo | 238 septic tanks, 12 small wastewater | The actual system is basically |
| | treatment plants, etc. | classified as the same system as the |
| Eydhafushi | 354 septic tanks, 17 small wastewater | plan. The difference is that the |
| | treatment plants, etc. | system does not have septic tanks |
| Muli | 136 septic tanks, 7 small wastewater | and has one wastewater treatment |
| | treatment plants etc. | plant in each island from where |
| | - | treated wastewater is discharged to |
| | | the sea. The plants have aeration |
| | | tanks |

| rubie 2. Comparison of Outputs, sewenage (plun and actual) | Table 2. | Comparison | of Out | puts: | sewerage | (plan | and actual) |
|--|----------|------------|--------|-------|----------|-------|-------------|
|--|----------|------------|--------|-------|----------|-------|-------------|

(Source: JICA documents, interview of consultants)



Sewerage pumping station, Funadhoo



Sewerage pumping station, Eydhafushi

The consulting services included provision of assistance in project management, detailed design, tendering, construction supervision, environmental research and monitoring, incorporation of social aspects, and training of government staff and target population and technology of transfer. They were implemented as planned. The actual man-months were 245.8 and almost the same as the original plan (244.8).

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost was lower than planned. The planned project cost was 3,252 million yen, 2,733 million yen of which was to be funded by the Japanese ODA loan. The actual project cost was 3,011 million yen in total (93% of the plan), 2,648 million yen of which were funded by the Japanese ODA loan (97% of the plan).

| | | | | | | | | (Unit: | million y | /en) |
|--------------------------|-----------------------|------------------|-------------|-------|---------------|-----------------------|------------------|-------------|-----------|-------------|
| | Plan (2006) | | | | Actual (2011) | | | | | |
| Item | Yen loan | Local cu | rrency | To | otal | Yen loan | Local c | urrency | То | tal |
| | (Foreign currency) | Local funding | Yen loan | Total | Yen loan | (Foreign currency) | Local funding | Yen loan | Total | Yen loan |
| Harbours | 1,690 | 0 | 89 | 1,779 | 1,779 | 1,757 | 0 | 0 | 1,757 | 1,757 |
| Sewerage | 301 | 0 | 16 | 317 | 317 | 459 | 0 | 0 | 459 | 459 |
| Price escalation | 52 | 0 | 0 | 52 | 52 | 0 | 0 | 0 | 0 | 0 |
| Contingency | 102 | 0 | 5 | 107 | 107 | 4 | 0 | 0 | 4 | 4 |
| Consulting services | 406 | 0 | 72 | 478 | 478 | 428 | 0 | 0 | 428 | 428 |
| Operation cost | 0 | 137 | 0 | 137 | 0 | 0 | 107 | 0 | 107 | 0 |
| Tax | 0 | 309 | 0 | 309 | 0 | 0 | 256 | 0 | 256 | 0 |
| Interest (local funding) | (73) | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2,551 | 446 | 182 | 3,252 | 2,733 | 2,648 | 363 | 0 | 3,011 | 2,648 |

Table 3. Project cost

Source: JICA documents

Exchange rate: At appraisal (June 2005) 1 US\$ =107 JPY, 1 US\$ =12.8 Rufiyaa, 1 Rufiyaa=8.36 JPY Average exchange rate in the project period (July 2006-December 2011): 1 US\$ = 98.32 JPY

Price escalation: Foreign currency 1.3% per year, local currency 0.0% per year

Contingency: 5%

According to the project consultants, the actual project cost of the sewerage systems was higher than planned because the original cost estimate (317 million yen for three islands, which meant about 100 million yen for one island) was much lower than the required cost. Other donors' similar projects (UNICEF and French Red Cross) needed about 200 million yen for one island. As the shortage was obvious at the beginning of the project, the consultants requested Ministry of Environment, Energy and Water Resources to reduce the number of target islands from three to two. However, the project kept the original three islands as the Ministry wanted to avoid political issues. The actual cost for the sewerage systems increased, but the total project cost was lower than planned as the increase was absorbed by the contingency.

3.2.2.2 Project Period

The project period was significantly longer than planned. The original project period was from July 2006 (L/A) to November 2009 (completion of consulting services) of 41

months in total. The actual project period was from July 2006 (L/A) to December 2011 (completion of consulting services) of 66 months in total, which was 161% of the plan.

| | Plan | Actual |
|--------------------------------|-----------------------------|----------------------------------|
| | (At time of L/A) | |
| Consulting services (including | Selection | Selection |
| selection of consultants) | May 2006 – July 2007 | May 2006 – December 2007 |
| | (15 months) | (20 months) (JICA documents |
| May 2006 – November 2009 | | state that it began in May 2007, |
| (43 months) in the appraisal | Work | which is likely to be an error) |
| documents | August 2006 – November 2009 | - |
| | (41 months) | Work |
| | | February 2008 – December 2011 |
| | | (47 months) |
| Tender and contract | Total | Total |
| | August 2006 – January 2007 | February 2008 – September 2008 |
| August 2006 – June 2007 (11 | (6 months) | (8 months) |
| months) in the appraisal | Harbours | Harbours |
| documents | August 2006 – November 2006 | February 2008 – September 2008 |
| | (4 months) | (8 months) |
| | Sewerage | Sewerage |
| | August 2006 – January 2007 | February 2008 – September 2008 |
| | (6 months) | (8 months) |
| Construction | Total | Total |
| | April 2007 – October 2008 | June 2009 – March 2011 |
| April 2007 – November 2008 | (19 months) | (34 months) |
| (20 months) in the appraisal | Harbours | Harbours |
| documents | April 2007 – July 2008 | June 2009 – March 2011 |
| | (16 months) | (34 months) |
| | Sewerage | Sewerage |
| | July 2007 – October 2008 | July 2009 – October 2010 |
| | (16 months) | (16 months) |

(Source: JICA documents)

Main reasons for the extension of the project period were as follows:

• This project was the first Japanese ODA loan project in Maldives and the executing agencies were not familiar with its procedures. It took 11 months to prepare tender documents for the selection of project consultants as the executing agencies did not have sufficient capacity to manage many projects, of their own and by donors, for recovery from tsunami damages. While the selected consultants provided assistance during project implementation, the project did not provide support for selection process itself. Approval process of the selection results by the relevant agencies also took long time. According to the JICA documents at appraisal, there was a discussion that this project should have been Grant Aid because the Government of Maldives might not have sufficient capacity in management of ODA loan project during the tsunami recovery. However, loan was selected because additional Grant Aid was not possible after the Japanese government had already implemented a non-project Grant Aid assistance of two billion yen.

• The period of consulting services was reasonably extended due to the extension of civil works for the replacement of one of the harbours. Maafushi was replaced by Ukulhas in September 2010. Ukulhas was to be supported by USAID, but was excluded due to lack of funding. JICA project took it as it met the site selection criteria and it did not receive support from the Government of Maldives or other donors. The period of harbour construction was extended until March 2011.

3.2.3 Results of Calculations of Internal Rates of Return

At appraisal, internal rate of return was calculated just for reference as it was not obliged in projects of reconstruction from disasters. The calculated Economic Internal Rate of Return (EIRR) was 18.2% for the harbours and 22.5% for the sewerage. The "costs" to calculate EIRR were project costs and operation and maintenance costs for both harbours and sewerage. The "benefits" were "shortened waiting time for tides in bad weathers", "decreased damage to the moored vessels" and "increased fish catches" for the harbours. For the sewerage, "benefits" were "decrease of costs to cover the shortage of water due to contamination of groundwater". As these data were not available at the time of ex-post evaluation, EIRR could not be re-calculated.

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

3.3 Effectiveness¹⁰ (Rating ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

Operation and effect indicators shown below were set at the time of appraisal to achieve the project objectives of "recovery of efficient movement of people and commodities and reliable sewerage services". There were no baseline data because the harbours were destroyed by the tsunami and the sewerage systems did not exist in the target islands at the time of appraisal.

3.3.1.1 Operation Indicators

(1) Harbours

As there are no data of the vessel arrival per week, it is difficult to measure the achievement of the target.

¹⁰ Sub-rating for Effectiveness is to be put with consideration of Impact.

| Harbour | Baseline data from | Target | Ex-post evaluation |
|----------------------|--------------------|-------------------|--------------------|
| | information from | (2011, two years | (2015) |
| | the Island Chief | after the | |
| | (July 2005) | completion of the | |
| | | Project) | |
| Funadhoo | 175 | * 310 | No data |
| Maafushi | 245 | * 434 | Excluded from the |
| | | | project |
| Ukluhas (added after | - | N/A | No data |
| the project started) | | | |
| Malé | - | 420 | No data |
| Dhiyamigili | - | 352 | No data |
| Isdhoo | - | 678 | No data |
| Isdhoo-Kalaidoo | - | 229 | No data |
| Fonadhoo | 210 | * 372 | No data |
| Dhaandhoo | - | 431 | No data |

Table 5Vessel arrival per week

(Source: JICA documents)

Note (*): Target numbers were agreed only about Funadhoo, Maafushi and Fonadhoo between the Government of Maldives and JICA.

As explained in the section of relevance, there is no system to capture the "number of vessel arrival" at the time of appraisal or at ex-post evaluation.

In Malé, about 200 vessels pay monthly mooring fees. Thus vessel arrival per week is likely to exceed 420 (the target of the project). As this project repaired only a part of the Malé harbour, it is impossible to know exactly the causality of the use of the relevant part of the Malé harbour and the effectiveness of the project. The vessel arrival was not recorded in other project target islands. However, the residents know very well about the vessels using the harbours as the islands and harbours are so small. The Island Councils consider that the number of vessels that use the harbours may exceed the project targets.

The Ministry of Economic Development has the register of vessels per atoll as shown in Table 6 below, while there are no statistics per island. The project target islands are atoll capitals or populated islands, thus considerable part of the registered vessels is likely to use the project target harbours. Along with the increase of the number of registered vessels in past six years, the number of the vessels that use the project target harbours is also likely to have increased.

| | Table 0. Registered vessels per au | | |
|------------|---|-------|--------|
| Atoll | Harbours rehabilitated by this project in | 2007 | 2013 |
| | the atoll | | |
| Shaviyani | (Funadhoo) | 383 | 520 |
| Kaafu | (Maafushi, Malé) | 3,323 | 4,354 |
| Alif Alif | (Ukulhas) | 208 | 278 |
| Thaa | (Dhiyamigili) | 394 | 605 |
| Laamu | (Fonadhoo, Isdhoo, Isdhoo-Kalaidhoo) | 225 | 293 |
| Gaafu Alif | (Dhaandhoo) | 147 | 275 |
| Nationwide | | 8,370 | 11,600 |

Table 6. Registered vessels per atoll

(Source : Maldives Statistical Yearbook)

From the above, it is likely that the number of vessels that use the target harbours of this project has increased along with the increase of the registered vessels per atoll while the data of vessel arrival per week are not available. There is no choice not to use the harbours as all commodities come through the harbours. As observed during the field visits of ex-post evaluation, people in the islands are living normal lives with adequate clothing and food. It means that the harbours are certainly utilized as expected.

(2) Sewerage

It is impossible to decide the level of achievement of the target because there are no BOD data at ex-post evaluation.

 Table 7.
 BOD at discharge (Funadhoo, Evdhafushi, Muli)

| Indicator | Target | Ex-post evaluation |
|--------------------------|------------------------|--------------------|
| | (2011, two years after | (2015) |
| | the completion of the | |
| | Project) | |
| BOD at discharge (mg/L) | Less than 30 | No data |
| (Source: JICA documents) | | |

Fenaka Corporation, which runs the sewerage services in the three target islands, did not measure BOD at the time of ex-post evaluation. Its Eydahafushi office does water quality testing once a month, but BOD is not measured. It measures pH of the second aeration tank, clarity in the pre-treatment pump and that in discharge pump as well as the water colour in every step of treatment. Data of pH and clarity meet the standard values set by Fenaka Eydahafushi office. Fenaka Funadhoo office used to do water quality testing almost every day until 2011, but it did not measure BOD. They think that they are not obliged to do water quality testing after the defects liability period expired. Fenaka Muli office does not perform water quality testing at all.

At appraisal, Island Development Committees were supposed to be responsible for the operation and maintenance of the sewerage systems. However, the function was transferred to regional utility companies in 2009 and in the following years. JICA technical cooperation project titled "Sewerage and Groundwater Management Project" (2009-2010) aimed at improvement of management capacity of the utility companies, but the companies measured different items using different formats of water quality testing.

The JICA technical cooperation project developed the "Standard procedure of sewerage concept design", the "Guidelines of sewerage concept design and design review", and the "Guidelines for operation and maintenance of sewerage system", which were approved by the Ministry of Housing and Environment and Environment Protection Authority in December 2010. The "Standard procedure of sewerage concept design" and the "Guidelines of sewerage concept design and design review" were about the design of

wastewater treatment facilities, and they required the design to conform to the standard set by the National Waste Water Quality Guidelines (January 2007), which set the limit of BOD at 40mg/L at discharge to the sea and 5mg/L at discharge to the ground. The "Design Criteria and technical specifications for conventional gravity systems 2013", currently valid, were developed based on these guidelines and require the facilities to make BOD at discharge to the sea below 20mg/L. The operation and maintenance guidelines of sewerage treatment plants do not exist as of 2015. Those developed by the JICA technical cooperation project did not intentionally set the standard of items to be measured. They just introduced some examples of other countries including Japan and expected the Government of Maldives to set the target later by its own initiative. According to current MEE, the operation and maintenance guidelines in 2007 are not valid any more. Their contents will be compiled into the Water and Sewerage Act, which is being drafted and to be approved by the Parliament in 2015. MEE is not able to regulate sewerage services as there are no regulations.

| Tuble 0. BOB5 in September 2011 | | | | | |
|---------------------------------|-----------------------------|----------------------------|--|--|--|
| Project site | Wastewater before treatment | Wastewater after treatment | | | |
| | (mg/L) | (mg/L) | | | |
| | (Raw sewage pump pit) | (Discharge pump pit) | | | |
| Funadhoo | 77 | 6 | | | |
| Eydhafushi | 112 | 7 | | | |
| Muli | 190 | 7 | | | |
| | | | | | |

Table 8. BOD5 in September 2011

(Source: JICA documents)

Note: the figures are of the defect liability inspection on 13 September 2011, after the completion and handover of the project facilities in October 2010.

after the completion and handover of the project facilities in October 2010.

At the defect liability inspection in 2011, BOD5 of treated water was better than the target of this project (30mg/L). In the project design, BOD5 of wastewater before treatment was estimated about 400mg/L and that of after treatment was about 100mg/L¹¹. According to the project consultants, the actual BOD5 after treatment was lower than anticipated because the actual BOD of pre-treatment wastewater was much lower than the original estimate. Muli's water quality after treatment did not meet the requirement at the defect liability inspection due to weak capacity of staff. In other two sites, water quality met the requirement and the capacity of staff was considered satisfactory.

3.3.1.2 Effect Indicators

(1) Harbours

No effect indicators were set at appraisal. At ex-post evaluation, the number of

¹¹ The reason for the discrepancy between these figures and the target of this project (30m/L) is unknown.

passengers or volume of cargo handled at the target harbours were considered as effect indicators, but such data did not exist and it was not possible to measure.

(2) Sewerage

At appraisal, "population treated", "the number of connection to the sewerage systems", and "the percentage of population treated" were agreed as effect indicators with the Government of Maldives. As the definitions of these indicators were not stated in the documents, general definitions as follows are utilized at the ex-post evaluation.

<u>Population treated:</u> Population in the areas served by the sewerage systems. It includes households in the area but not connected to the sewerage systems.
 <u>Number of connection to the sewerage systems:</u> Actual number of connections.
 <u>Percentage of population treated:</u> Percentage of "Population treated" (above) in the total population of the administrative unit (in this project, population of the island)

<u>Population treated</u> achieved the target (4,800 in the three islands) as shown in Table 9. The reason for the discrepancy between the number from MEE and the census results in October 2014 is unknown. The census was implemented in 2014 for the first time since March 2006, so the trend of population change is not captured as there are no population data per island between the two censuses.

| | | | | | | (Unit: person) |
|------------|--------|-------------|---------------|----------------|----------------|----------------|
| | Target | | Act | tual | | Census results |
| | | | | | | |
| | 2011 | 2011 | 2012 | 2013 | 2014 | October 2014 |
| | | (Project | (1 year after | (2 years after | (3 years after | (Preliminary |
| | | completion) | the project | the project | the project | results) |
| | | | completion) | completion) | completion) | |
| Funadhoo | | 2,300 | 2,341 | 2,390 | 2,424 | 2,099 |
| | | | | | | |
| Eydhafushi | | 3,047 | 3,121 | 3,168 | 3,197 | 2,626 |
| - | | | | | | |
| Muli | | 893 | 918 | 936 | 959 | 862 |
| 合計 | 4,800 | 6,240 | 6,380 | 6,494 | 6,480 | 5,588 |

Table 9Population treated

(Source: Population served is from the questionnaire response from MEE. Census results are from Population and Housing Census 2014, Preliminary Draft 13 Nov. 2014, National Bureau of Statistics)

Number of connection to the sewerage systems and Percentage of population treated

The number of connection achieved the target. The percentage of population treated also achieved the target because all households in the target islands were connected to the sewerage systems according to the Island Councils and Fenaka offices in the islands.

Table 10. Number of connection to the sewerage system and Percentage of population treated

| | Number of connection to the | | | Percentage of |
|------------|-----------------------------|--------------------|-----------|-----------------------|
| | sewerage system | | | population treated |
| | | | | (Target: 100%) |
| | Target | Actual | Number of | Actual |
| | (2011) | (2014) | household | (2014) |
| | | 3 years after | (2006) | 3 years after project |
| | | project completion | | completion |
| Funadhoo | | 380 | 231 | 100% |
| Eydhafushi | | 709 | 344 | 100% |
| Muli | | 208 | 132 | 100% |
| 合計 | 730 | 1,297 | 707 | 100% |

(Source: Number of household in 2006 is from the census. Number of connection in Eydahafushi is from the website of Fenaka Corporation. The number of connection and number of household in Funadhoo and Muli are from the confirmation of the Island Councils and Fenaka in the islands that all households were connected.)

According to the project consultants, almost all houses in the three islands were connected to the sewerage systems except for five buildings such as barns that did not need sewerage. Since the project completion, new housing areas have been developed by reclamation, but the houses are not built or not inhabited yet, and they are not connected to the sewerage. Therefore all inhabited houses are connected to the sewerage systems. Fenaka Funadhoo office mentioned that there would be no technical or equipment problem to connect new houses to the system. Fenaka in other two islands do not have necessary equipment and are not confident. Fenaka island offices do not charge connection fees from users.

3.3.2 Qualitative Effects

The beneficiary reported that the harbours became safer and more user-friendly according to the beneficiary surveys¹² (Figure 2) and the interviews during the site visits. The quay walls were simple before the tsunami, but the height and the side of the quay walls were improved and the loading and unloading of cargo became easier.

Effectiveness is high as the expected outcomes are considered realized. The harbours are fully utilized as expected because all commodities come to the islands through them and the people live the normal lives, and the number of vessels that use the project target harbours is likely to have increased along with the increase of the number of registered vessels per atoll to which the project target harbours belong. Regarding the sewerage, while BOD data did not exist at the time of ex-post evaluation, BOD5 before treatment was lower than anticipated and that after treatment was much better than the target at the

 $^{^{12}}$ The beneficiary surveys were conducted by the local consultants with 70 people in Fonadhoo for the harbour part (36 men and 34 women from age 17 to 72 of various occupations) and 63 people in Eydahafushi for the sewerage part (18 men and 45 women from age 18 to 80 of various occupations) using the prepared questionnaire. The participants in the surveys were selected to represent different sex, age and occupation with assistance of the Island Councils.

defect liability inspection in 2011, and the sewerage system was functioning without major problems at the time of ex-post evaluation and the users were satisfied as shown in the beneficially survey results shown in the next section. Therefore the sewerage service is provided as expected. The effect indicators of the sewerage have also achieved the target.

3.4 Impacts

3.4.1 Intended Impacts

(1) Improvement of living conditions

According to the beneficiary survey, the living conditions in the islands has improved compared to those before the tsunami, such as the volume and variety of commodities available in the islands has increased and access to the schools and health facilities has improved. The activities of fishers did not change in particular. The majority of respondents did not see the increase in the frequency of travel to other islands, the increase of income or the increase of employment opportunities.

Figure 2. Result of beneficiary survey (Fonadhoo harbour)

The respondents compared the situation before Tsunami and current conditions after the project completion (70 respondents).

| Harbour is safer than before Tsunami. | 60% |
|--|-----|
| Harbour is more user-friendly than before | 75% |
| Tsunami. | |
| Harbour is more solid against earthquakes or | 2% |
| tsunami | |

| Frequency of travel to other islands | Increased 51% | Did not increase 49% |
|--------------------------------------|---------------|----------------------|
| Income | Increased 31% | Did not increase 69% |
| Employment opportunities | Increased 34% | Did not increase 66% |
| Volume and variety of commodities | Increased 80% | Did not increase 20% |
| available in the island | | |
| Condition of harbour | Improved 98% | Did not improve 2% |
| (fishers) number of fishing days | Increased 12% | Did not increase 88% |
| (fishers) damage to the vessels | Decreased 7% | Did not decrease 93% |
| (fishers) fish catches | Increased 6% | Did not increase 94% |

New or increased employment opportunities include staff of ferries. Commodities with more varieties and volume available in the island include food, clothing, daily necessities, and construction materials.

| Migration to other islands | Increased | 45% | Same | 36% | Decreased 19% |
|---------------------------------|-----------|-----|------|-----|------------------|
| Migration to this island | Increased | 86% | Same | 14% | Decreased 0% |
| Access to social services | Increased | 76% | Same | 24% | Decreased 1% |
| (schools and health facilities) | | | | | |
| Business | Increased | 88% | Same | 12% | Decreased 1% |
| Income of the island and atoll | Increased | 68% | Same | 12% | Decreased 0% |
| Safety | Improved | 46% | Same | 44% | Deteriorated 10% |
| Tourism | Improved | 53% | Same | 44% | Deteriorated 3% |
| Quality of seawater | Improved | 24% | Same | 61% | Deteriorated 14% |
| Environment | Improved | 27% | Same | 58% | Deteriorated 15% |

The results of the beneficiary survey show that people are satisfied with the sewerage systems in general. Since the drinking water comes from wells (groundwater) and rainwater, the sewerage is expected to mitigate the contamination of groundwater. While there are no data about the quality of groundwater and waterborne diseases, many respondents confirmed the improvement of quality of groundwater and seawater.

Figure 3. Result of beneficiary survey (Eydahafushi sewerage)

The respondents compared the situation before Tsunami and current conditions after the project completion (63 respondents).

| Treatment of wastewater | Improved 84% | Did not improve 14% |
|---------------------------------------|---------------------------------------|--|
| from home | (there was no sewerage before) | (there is odour sometime) |
| Hygiene in house | Improved 92% | Did not improve 8% |
| Quality of water of the well | Improved 82% (less odour) | Did not improve 18% (bad smell and salty taste) |
| Quality of seawater | Improved 78% (cleaner than before) | Did not improve 22% (in some areas seawater is dirty) |
| Satisfaction with the sewerage system | Satisfied 95% | Not satisfied 5% |

Some respondents pointed out odour around the wastewater treatment plant.

(2) Economic recovery of the country

There were no data available to show that this project contributed to the economic recovery at the national level. Even if data are available, it is not possible to assume the causality between the effectiveness of this project and economic recovery of the country because this project rehabilitated harbours of only eight islands among 199 inhabited islands in Maldives and the tourism industry, the biggest source of income of the country, is operated in the resort islands which are virtually detached from the normal islands. Still, the result of the beneficiary survey shows that the project contributed to economic recovery of the project target islands because the volume and variety of commodities available in the islands increased compared to the period before Tsunami, and many assume that business opportunities in the islands as well as income of the island and atoll increased.

3.4.2 Other Impacts

(1) Impacts on the natural environment

At appraisal, the project was classified as a "B" category¹³ project according to the

¹³ Category A: to be applied to the project, in which seriously unfavorable impacts to the environment and community are concerned. Category B: to be applied to the project, in which unfavorable impacts to the environment and community are considered smaller compared with Category A.

"JBIC Environmental Guidelines to be used for Safeguard Issues under the ODA Loan Project (April 2002)", which would not have big negative impact on natural environment. The project areas and the areas around them were not a preserve and there were no coral leafs around the harbours. Thus no severe negative impacts on natural environment were foreseen. Methods to prevent contamination of the seawater during dredging and excavation were to be used during the construction of harbours. Therefore no negative impact on the quality of seawater was anticipated. The quality of treated wastewater was to meet the international standards and also no negative impact on the quality of seawater was anticipated.

The Ministry of Environment, Energy and Water Resources gave this project an environmental approval just after the detailed design and before the selection of contractors of civil works, as planned. During the project implementation period and at the project completion, environmental monitoring was carried out according to the Environmental Impact Assessment Decision Statement of the Environmental Protection Authority and the Ministry of Environment, Energy and Water Resources as shown in Table 11.

| Items to be monitored | Result |
|--|--|
| Condition of coral leafs | No change before/after the Project. |
| Change of fishes around the island | No change before/after the Project. |
| Change of the current of the sea in the | No change before/after the Project. |
| harbour and at the entrance of the harbour | |
| Quality of seawater inside and outside of | The measured items always met the standard. |
| the harbour | |
| Change of the current of the sea around | There was sedimentation of mud in the bottom |
| the island | of the sea in some areas, but there was no |
| | serious impact on the natural environment. |
| | Some coast lines were eroded and protection |
| | works were done using rocks. |
| Waste management | Wastes were segregated and appropriately |
| | disposed. |

Table 11. Result of environmental monitoring

(Source: JICA documents)

The beneficiary survey result shows that many people in the islands consider that quality of groundwater and seawater improved, and there were no information to indicate negative impact of the sewerage on the natural environment. Similarly, there was no information to indicate negative impact of the harbours on the natural environment.

(2) Land Acquisition and Resettlement

MHI and MEE confirmed that there was no resettlement or land acquisition in the project.

(3) Other Positive and Negative Impacts

Some people in the islands were employed and trained during the construction and test runs of the sewerage facilities. Some of them continue working in the current Fenaka offices. The project has contributed to employment creation in the islands to some extent.

Effectiveness is high as the expected outcomes were realized. The harbours are fully utilized as expected because all commodities are delivered to the islands through them and the people live the normal lives using these commodities, and the number of vessels that use the project target harbours is likely to have increased along with the increase of the number of registered vessels per atoll to which the project target harbours belong. The sewerage service has been provided as expected. While BOD data did not exist at the time of ex-post evaluation, BOD5 before treatment was lower than anticipated and that after treatment was much better than the target at the defect liability inspection in 2011, and the sewerage system is functioning without major problems and the users are satisfied. The effect indicators of the sewerage have achieved the target. Regarding impacts, the living conditions of the people in the islands have been improved compared to those before the tsunami as the commodities available in the islands have increased in terms of number and variety, access to the social facilities such as health centres and schools has improved, and the hygiene and the quality of ground and seawater has improved according to the beneficiary surveys. In total, effectiveness and impact of the project are high as it has largely achieved its objectives.

3.5 Sustainability (Rating: 2)

3.5.1 Institutional Aspects of Operation and Maintenance

Until 2010, the Island Chief appointed by the President headed the Island Development Committee, the administrative structure of an island. The Island Development Committee was responsible for operation and maintenance of the harbours and it did minor repair using their annual budget. Major repairs were conducted under the Atoll Chief using the atoll budget, based on the request from the Island Chief. More serious repairs were requested to the Ministry of Atoll Development and budget from the Ministry of Planning and National Development was obtained¹⁴.

Since sewerage systems did not exist in the project target islands, there was no operation and maintenance structure at the time of project appraisal.

At appraisal, operation and maintenance structure of the harbours and sewerage rehabilitated by the project was planned as follows:

Harbours (except for Malé): The Island Development Committee is responsible for daily

¹⁴ JICA documents

operation and maintenance such as patrolling, management of mooring, repair of the facilities and dredging. The Ministry of Construction and Public Infrastructure monitors the harbours and provides funding.

<u>Malé harbour</u>: The Ministry of Construction and Public Infrastructure is responsible for operation and maintenance.

<u>Sewerage:</u> The Island Development Committee establishes operation and maintenance committee to do daily operation and maintenance including cleaning of septic tanks, management of sludge, exchange of pumps, management of wastewater treatment plant and repair, by collecting user fees and employing staff. The Ministry of Environment, Energy and Water Resources provides monitoring and funding. The Ministry develops guidelines of the funding and organizations of operation and maintenance as well as operation and maintenance plan of each target island.

(Source: JICA documents, interview of project consultants)

After restructuring of ministries several times, the harbours are under the jurisdiction of MHI and the sewerage systems are under MEE since 2012. By the Decentralisation Act 2010 and Local Council Election Act 2010, the local administrative structure of Maldives consists of 20 Atoll Councils, two City Councils for the island with population of more than 25,000 (Malé and Addu) and 189 Island Councils¹⁵. Decentralization Act 2010 designates the Island Councils to conduct the operation and maintenance of basic infrastructure and provision of services such as maintenance of roads, utility services (electricity, water supply and sanitation), education and health care¹⁶. Thus the Island Councils are responsible for the operation and maintenance of the harbours, which is same as planned at appraisal. However, the Island Councils are not related to the former Island Development Committees.

Despite the Decentralization Act, sewerage services are provided by the utility companies and the role of the Island Councils is limited to coordination with the companies. MEE started shifting of the utility services from the local administration to the public companies in 2009, and six regional public utility companies were established in 2009 and 2010. In December 2010, operation and maintenance of sewerage systems began to be transferred to the utility companies in some regions. The reconstruction of sewerage systems by this project were completed in October 2010 and they have operated by the regional utility companies since the beginning of 2011. The Presidential Decree of 18 June 2012 declared establishment of Fenaka Corporation, a 100% state owned company which was to provide utility services in all regions except for Malé. All regional utility companies were merged to Fenaka¹⁷.

The institutional arrangement of operation and maintenance is as follows at the time of

¹⁵ Elections of local councils were held twice in February 2011 and February 2014. The number of Island Council members is between five and nine according to the population of island.

¹⁶ Commonwealth Local Government Forum, Country Profile. http://www.clgf.org.uk

¹⁷ Website of President's Office of Maldives and information from the project consultants

ex-post evaluation. The government clarifies the responsibility that, , while provision of basic infrastructure and services is the role of the Island Councils, the utility services are provided by Fenaka.

(1) Harbours

MHI develops the construction and maintenance plan of all harbours and implements major repairs. MHI considers that once a harbour went through major repair or maintenance work, only minimum maintenance work would suffice for ten years. MHI prioritizes the harbours that have not been repaired yet, and it does not intend to repair the project target harbours. In general, dredging in the harbour is necessary after about five years of major maintenance work and the Public Works Services Department of MHI is developing the dredging plan of all harbours. Staff employed for the project has already left MHI, but the section remains to be responsible for operation and maintenance and started monitoring in 2014.¹⁸

Daily operation and maintenance of Malé harbours are handled by Malé City Council which has five administrative staff and 15 patrol staff for the harbours. They patrol the harbours, collect user fees and do minor repairs such as mooring hooks. The City Council has annual operation and maintenance plan of the harbours, but it is not necessarily able to implement all items due to shortage of funds and human resources.

In other islands, Island Councils do daily operation and maintenance of harbours. They do not have a system to record the physical status or operation of the harbours, but they are always aware of the status through information from people and own experience as users, and take necessary actions as required such as reporting to MHI. The Island Councils do minor repairs such as dents of quay walls using the budget of the Councils. They do not have designated staff or experts in harbours and their role is in principal coordination with MHI and relevant companies. This is same in other sectors such as electricity, water and sanitation, education and health services¹⁹.

 ¹⁸ From the interview and questionnaire response of MHI.
 ¹⁹ From the interviews of Island Councils, and interview and questionnaire response of MHI.





(2) Sewerage

Each Fenaka island office has about two to three staff for sewerage in addition to those for electricity²⁰. According to Fenaka Head Office and its island offices, the number of staff is minimal to perform the duties. Daily operation and maintenance are implemented by Feneka island offices and replacement parts are purchased by the head office²¹.



²⁰ While water supply and sewerage services are usually provided by the same entity and the user fees are collected together in many countries, Fenaka does not provide water supply services in the three target islands because there are no water supply network and people obtain water from individual wells and rainwater tanks. Almost 100% of Feneka's income is from the electricity fees as stated in the section of financial sustainability below.

²¹ From the interview and questionnaire response of MEE and interview of Feneka.



The original plan at appraisal to assume the Island Development Committees the role of operation and maintenance of sewerage systems and the residents participate as volunteers was realistic under the administrative structure at that time. However, it is no longer appropriate to have volunteers who provide operation and maintenance works under the Island Councils because of technical constraints and moral issues even if the system is relatively simple. Under the current administrative structure, it is reasonable that the Island Councils monitor the condition of the facilities and do minor repairs of the harbours and that Fenaka Corporation provides sewerage services.

3.5.2 Technical Aspects of Operation and Maintenance

(1) Harbours

MHI has enough technical capacity to implement harbour maintenance works because the harbours in Maldives have not had major problems except for the large damages by the tsunami. However, MHI was not able to provide information about the technical levels of staff and their training record.

Malé City Council has enough technical capacity to carry out minor repairs such as mooring hooks. While Island Councils do not have technical experts, they can arrange necessary human resources for minor repairs when necessary. There seem to be no problem with repaired parts of the harbours, which supports the assumption that the Island Councils have capacity to arrange and supervise such minor repair works.

(2) Sewerage

According to MEE, the sewerage is a new sector in Maldives and there are no regulations or water quality guidelines. Therefore MEE is not able to regulate the sewerage service providers. As explained above, the JICA technical cooperation project developed operation and maintenance guidelines of the wastewater treatment plants and

trained staff of the regional utility companies including the sites of this project. However, these guidelines are no longer valid, and the contents are going to be incorporated in the Water and Sewerage Act which is being developed and is to be approved by the Parliament in 2015. From the above, the technical capacity of MEE is not sufficient.

In the target islands, volunteers were to be trained to handle operation and maintenance works under the Island Development Councils. However, volunteers were not trained because these works were designated to the regional utility companies. As this project and the JICA technical cooperation project were not able to train the utility companies directly, the technical cooperation project supported the Ministry of Housing, Transport and Environment in implementation of training for the companies. During the construction and test run, three to five staff of each utility company were trained in operation and water quality control. At the defect liability inspection in September 2011, which was one year after the completion of this project, the utility company offices in Eydhafushi and Funadhoo continued water quality testing, but Muli had stopped it because the trained staff left. At that time, the quality of treated water in Muli did not meet the standard due to insufficient capacity of staff and insufficient treatment of solid matters in the first treatment tank because of insufficient aeration. In other two sites, there was no problem with the quality of treated water and technical capacity.

In Fenaka Eydhafushi office, two of three trained staff already left, and two new members recently joined. Therefore, the technical capacity is not enough. Funadhoo office has four technicians and all of them were trained either by the project or previous jobs such as water supply project supported by other donors. The two staff of Muli office have not received any training as they joined the team after the project ended. According to the head office, Fenaka has not implemented trainings in sewerage operation and maintenance since its establishment in 2012. They were not able to provide information of their human resources. Therefore, technical capacity of Fenaka Corporation is not sufficient.

From the above, the technical capacity in operation and maintenance is only partially appropriate.



Control panel of wastewater treatment plant, Fenaka (Eydhafushi)



Water quality testing record, Fenaka (Funadhoo)

3.5.3 Financial Aspects of Operation and Maintenance

(1) Harbours

Major repairs of the harbours are supposed to be financed by MHI, but figures of such funding were not provided by them. The project target harbours have not experienced major repairs since the project completion. MHI was not able to provide budget information of the repair plan of harbours in Maldives.

Malé City Council collects mooring fees of 75 Rufiyaa per vessel per month. As about 200 vessels pay mooring fees, the Council receives about 15,000 Rufiyaa per month. Council's budget for operation and maintenance of harbours is about 10 million Rufiyaa per year, which covers also the salary of staff and cleaning cost. This budget is sufficient to perform daily operation and maintenance such as minor repairs, patrol and cleaning.

Other Island Councils do not charge user fees of harbours. Minor repairs are carried out by the Councils using their budget when necessary. Funadhoo Island Council repairs dents on the quay wall regularly (once every six months) and pays about 35,000 Rufiyaa each time, which amounts to 70,000 Rufiyaa per year. As about 20 dents are repaired every time, the repair of a dent costs about 1,700 Rufiyaa. Funadhoo Island Council owns power plants and operates electricity business without transferring it to Fenaka, and it earns about 1.8 million Rufiyaa per year from it. The Council uses this income for repair of the harbour and other development projects such as waste management and construction of school buildings. Other Island Councils repair dents and other defects of the harbours at ad-hoc basis. Information of actual expenditure of such repair was not available, but as the size of quay walls is smaller than that of Funadhoo, it is assumed that other Councils pay about 10,000-20,000 Rufiyaa every time. The amount is small and there is no particular problem in finance.

| L. | · · · · · |
|--|-------------|
| Income | Rufiyaa |
| Allocation from the government | R4,000,000 |
| Income from electricity business | R1,800,000 |
| Income from cable TV business | R36,000 |
| Sub total | R5,836,000 |
| | |
| Expenditure | |
| Council operations (Recurrent cost) | R4,000,000 |
| Development Project | R1,800,000 |
| Repair of the harbour: R70,000 per year | |
| Construction of waiting space for the users of the | |
| harbour: R280,000 (total budget) | |
| Waste management, construction of school buildings | |
| Sub total | R58,000,000 |

Table 12. Income and expenditure of Funadhoo Island Council (2015)

(Source: Funadhoo Island Council)



Fonadhoo harbour: dent on quay wall (other harbours have similar dents)



Fonadhoo harbour Unloading of cargo

(2) Sewerage

Feneka Corporation does not charge fees for sewerage services, nor for water supply services, while it does not provide water supply services in the project target islands. Almost all income of Fenaka comes from electricity fees, and operation and maintenance cost of the sewerage facilities is also covered by it. Fenaka island offices do not know about their operation and maintenance budget and expenditure because they do not count additional human resource cost for operation and maintenance works as they are within the regular work. Spare parts are purchased by the head office and island offices do not have to budget the cost. Fenaka Corporation is a 100% state owned company to provide utility services, and it does not aim to produce profit. It might consider charging fees of sewerage services in the future, but it does not have an immediate plan to do so. It was not able to provide information about its financial status.

Both harbours and sewerage facilities are not likely to have immediate financial problems as daily operation and maintenance are performed. However, as MHI and Fenaka Corporation did not provide financial information, the financial aspects are partially appropriate.

3.5.4 Current Status of Operation and Maintenance

(1) Harbours

The harbours are in good condition in general and well utilized. While they experience minor damages such as a breakage of mooring hooks due to tensions by strong winds and dents of the quay walls, there is no major problem. Dents and cracks of quay walls occur due to leakage of sands in the structure into the sea, and the Island Councils repair them using their budget when necessary. Funadhoo Island Council repairs them regularly.

In Funadhoo harbour, there are panels which indicate the designated mooring spaces for vessels according to size and type (passenger boats or cargo vessels). It also has a plan to construct a covered waiting space for passengers. It seems that Funadhoo Island Council has stronger ownership to perform operation and maintenance than other Island Councils.



Funadhoo harbour



Funadhoo harbour Panel to show the mooring space of vessels according to size (from 35 to 100 feet)

(2) Sewerage

The sewerage facilities are in good condition in general and utilized without major

problems. Fenaka island offices inspect the facilities about once a month. During four years after the project completion, they have not experienced major repairs while there are minor deteriorations such as painting in the manholes. Fenaka offices fix the blockage or flooding when necessary. They are not always able to obtain spare parts in time, and there are occasions that only some pumps are working. In Funadhoo, one of the two generators has been broken down since 2014 and Fenaka island office is still waiting for a replacement from the head office. Some pumps in the underground were broken at some time, and they were all repaired by February 2015. There are some other problems as follows:

- Sewerage systems are sometimes blocked as users dispose materials in connection pits or toilets. The project consultants trained the users not to do so, but some lack moral of residents were observed.
- Flooding occurs sometime during heavy rains while the project adopted the sewerage system to separate rainwater and wastewater, and rainwater cannot enter into the system from the manholes. The roads in the target islands are not paved and rain water are usually absorbed in the ground. However, paddles of water can appear in the lower parts of the roads. Clogging in the connection pits could lead to overflow.

Some minor problems have been observed in terms of technical aspects in inheritance of skills and training, as well as in terms of financial aspects. Therefore sustainability of the project effects is fair.

4. Conclusions, Recommendations and Lessons Learned

4.1 Conclusions

The objective of the project was to provide efficient transportation and reliable sewerage services by reconstructing the harbours in eight islands and sewerage systems in three islands in Maldives damaged by the tsunami caused by the Indian Ocean earthquake in December 2004, thereby contributing to the improvement of the living conditions of the affected people and to the recovery of the economic conditions of the country.

Relevance of this project is high, as it has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Efficiency is fair, as the outputs were produced as planned and the project cost was lower than planned, but the project period was significantly longer than planned. Effectiveness is high as the expected outcomes were realized. The harbours are fully utilized as expected because all commodities have been delivered to the islands through them and the people live the normal lives using these commodities, and the number of vessels using the project target harbours is likely to have increased along with the increase of the number of registered

vessels per atoll to which the project target harbours belong. Although BOD data did not exist at the time of ex-post evaluation, the sewerage service is also likely to have been provided as expected because BOD5 before treatment was lower than anticipated and that after treatment was much better than the target value at the defect liability inspection in 2011, and the sewerage system is functioning without major problems and the users are satisfied. The effect indicators of the sewerage (population treated, number of connections and percentage of population treated) have achieved the target. Regarding impacts, the living conditions of the people in the islands have been improved compared to those before the tsunami as the commodities available in the islands have increased in terms of number and variety, access to the social facilities such as health centres and schools has improved, and the hygiene and the quality of ground and seawater have improved according to the beneficiary surveys. In total, effectiveness and impact of the project are high. Regarding sustainability, there are no major problems in institutional aspects as the roles of each organization are established, while the operation and maintenance organizations at ex-post evaluation are different from the plan due to the changes of the national administration structures and government policies. Some minor problems have been observed in terms of technical and financial aspects. Therefore the sustainability of the project effects is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agencies

The sewerage sector in Maldives does not have sufficient capacity and experience in operation and maintenance because the sector is new in the country. MEE is planning to have the new Water and Sewerage Act in 2015 and the Act will become the basis to regulate the sewerage service providers. It is recommended that MEE should establish the water quality standards of the treated and discharged wastewater and require the service providers to perform water quality testing.

4.2.2 Recommendations to JICA

None.

4.3 Lessons learned

(1) Indicators of emergency assistance projects

The data of indicators set by the project did not exist and were difficult to monitor, but it seems to have missed the objectives of the project to aim at quick recovery of normal lives of the people affected by the disaster. The data to show the utilization of harbours do not exist, but the fact that people in the islands live normal lives means that the necessary commodities come to the islands through the harbours, and therefore they are utilized. However, there are no data to show that the people live normal lives except for the subjective impression of the beneficiaries and the consumption of food or purchase of commodities, but collection of such data would not be realistic in terms of cost and benefit. There would not be any other appropriate indicators or data. The World Bank and ADB set up only output indicators such as length of repaired quay walls, and this project, therefore, also could have set up output indicators as such.

(2) Provision of assistance in project management in emergency project

This project was the first Japanese ODA loan project for Maldives and the government were not familiar with the procedure of the selection of project consultants and it is likely to be difficult to handle it along with its own and many donor-supported recovery/reconstruction projects. It took long time for the selection of the project consultants and the project period was considerably longer than the plan. This project did not support the selection of consultants itself. Such emergency projects would need assistance in project management such as experts to support selection of consultants.

| Item | Original | Actual |
|------------------------------------|---|---|
| 1. Project Outputs | | The actual outputs were as planned with slight modification as a result of the Detailed Design. |
| Civil engineering | Funadhoo Quay wall (370m), Breakwater (120m), etc. Maafushi Quay wall (150m), Breakwater (150m), etc. Malé Quay wall (110m) Dhiyamigili Quay wall (158m), Breakwater (300 m), etc. Isdhoo Quay wall (14m), etc. Isdhoo-Kalaidhoo Quay wall (19m), etc. Fonadhoo Quay wall (220m), Breakwater (70 m), etc. Dhaandhoo Quay wall (150m), etc. | Funadhoo Quay wall (370m), Breakwater (112m+305m), etc. Ukulhas (replaced Maafushi) Breakwater etc. Malé Quay wall (110m), Pavement and navigation aid Dhiyamigili Quay wall (200m), Breakwater (70m+135m) Isdhoo Quay wall (200m), Breakwater (132m), etc. Isdhoo-Kalaidhoo Quay wall (14m), Breakwater (132m), etc. Fonadhoo Quay wall (267m), Breakwater (80m), etc. Dhaandhoo Quay wall (223m), Breakwater (216m), etc. |
| Sewerage | Funadhoo Eydhafushi Muli | The actual outputs were same as planned while they were without individual septic tanks. Both types belong to the same sewerage system. |
| Consulting services | i) Management of the project ii) Detailed design iii) Tendering iv) Construction supervision v) Environmental research and monitoring vi) Incorporation of social aspects vii) Training of government staff and target population | Same as planned |
| 2. Project Period | July 2006-November 2009 (41 months) | July 2006 -December 2011 (66 months) |
| 3. Project Cost | | |
| Amount paid in Foreign currency | 2,551 million yen | 2,648 million yen |
| Amount paid in Local currency | 628 million yen (75 million Rufiyaa) | 363 million yen (39 million Rufiyaa) |
| Total | 3,252 million yen | 3,011 million yen |

Comparison of the Original and Actual Scope of the Project

| Japanese ODA loan portion | 2,733 million yen | 2,648 million yen |
|------------------------------|--|---|
| Exchange rate | 1 US\$ =107yen, 1 Rufiyaa=8.36yen (As of June 2005) | 1US\$ = 98.32yen, 1 Rufiyaa=9.34 yen (Average between July 2006 and December 2011) |