

Lao People's Democratic Republic

FY2018 Ex-Post Evaluation of Japanese Grant Aid Project
“The Project for Improvement of Solid Waste Management in
Environmentally Sustainable Cities”

External Evaluator: Hideyuki Takagi, Ernst & Young ShinNihon LLC

0. Summary

This project was implemented to improve waste collection and transportation efficiency in the Laos capital of Vientiane, the Luang Prabang district and the Xayabouri district (which are positioned as environmentally sustainable cities in the integration roadmap for Laos set forth by the Association of Southeast Asian Nations (ASEAN)), by constructing a solid waste transfer station and providing equipment related to solid waste management such as waste collection vehicles, thereby contributing to the improvement of the hygienic environment in these cities.

The project is sufficiently consistent with the development plan and development needs of Laos, as well as Japan's ODA policy. Therefore it is highly relevant to Laos' development plan and needs as well as Japan's ODA policy. Although the outputs of the project and the project period were mostly in line with plans, project costs slightly exceeded the plan. Therefore, the efficiency of the project is deemed to be fair. The target volume of waste collected has mostly been achieved in the three target cities. Improvements were most significant in Vientiane where the majority of the project output was accounted for. As a result, the waste collection rate, defined as the development need of the project, has significantly improved in the three target cities. Based on this observation, the effects of the project were mostly achieved as planned; therefore, the project is deemed to be highly effective and have a strong impact. The institutional and organizational aspects of environmental management have been developed, and no major problems have been observed with regards to the technical and financial aspects of the urban development administration agencies, which are the operation and management agencies involved in the project (hereinafter referred to as the “O&M agencies”). In addition, the facility and vehicles provided through the project have been maintained in good condition. Therefore, the project's effects are deemed to be highly sustainable.

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

1. Project Description

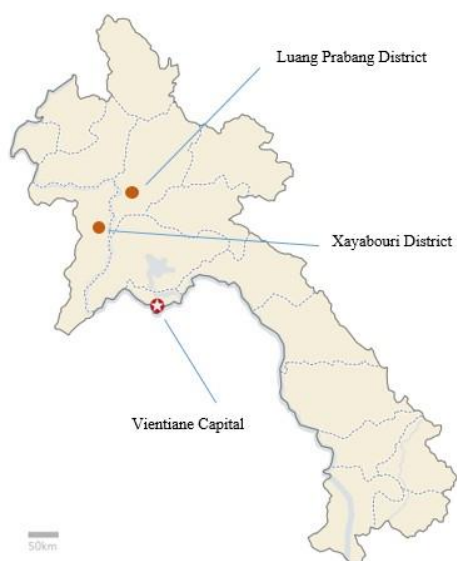


Figure 1. Project Location



Photo 1. Transshipment of waste carried by a skip loader at the solid waste transfer station (Vientiane)

1.1 Background

It has been a challenge in Laos to address the increase in waste generation accompanying economic development. The target cities of the project, namely the Laos capital of Vientiane, the Luang Prabang district and the Xayabouri district, are positioned as Environmentally Sustainable Cities in the ASEAN integration roadmap. Meanwhile, in addition to the fact that waste collection rates have remained low due to inefficient collection and transport methods, waste generation has been expected to increase alongside population growth. Waste collection rates in the three target cities were approximately 20%, 60%, and 40%, respectively, and the uncollected waste has been disposed of through dumping and burning, leading to pests and odors. The largest factor underlying these problems is the inefficiency of waste collection and transportation methods. Accordingly, there has been an urgent need to improve the efficiency, and thus the capacity, of solid waste treatment.

Under these circumstances, the project was planned with the aim of achieving environmentally sustainable cities, through synergies with the environmental management component of Laos Pilot Program for Narrowing the Development Gap towards ASEAN Integration (hereinafter referred to as “LPPE”), a related project implemented prior to the project. The project and LPPE were mutually complementary. The aim of the synergies was to improve the waste management capabilities of O&M agencies by enhancing their human resources through LPPE and expanding physical resources such as solid waste transfer

stations and waste collection vehicles through the project. In particular, it was necessary to establish a solid waste transfer station and take measures to efficiently transport waste collected in Vientiane, since the final disposal site was 32 km away from the urban area.

1.2 Project Outline

The objective of the project was to improve waste collection and transportation efficiency in the Laos capital of Vientiane, the Luang Prabang district and the Xayabouri district, which are positioned as environmentally sustainable cities in ASEAN’s integration roadmap for Laos, by constructing a solid waste transfer station and providing equipment related to solid waste management such as waste collection vehicles, thereby contributing to the improvement of the hygienic environment in these cities¹.

Grant Limit / Actual Grant Amount	1,384 million yen / 1,303 million yen
Exchange of Notes Date / Grant Agreement Date	March 2014 / March 2014
Executing Agency	Department of Housing and Urban Planning, Ministry of Public Works and Transport
O&M Agencies	<ul style="list-style-type: none"> • Vientiane Urban Development Administration Authority • Luang Prabang Urban Development Administration Authority • Xayabouri Urban Development Administration Authority
Project Completion	January 2016
Main Contractors	Construction: Sato Kogyo Co., Ltd. / Toyota Tsusho Corporation (JV) Procurement: Toyota Tsusho Corporation
Main Consultant	Kokusai Kogyo Co., Ltd.
Preparatory Survey	August 2013 – March 2014
Related Projects	JICA Technical Cooperation Projects: <ul style="list-style-type: none"> • The environmental management component of the Laos Pilot Program for Narrowing the Development Gap towards ASEAN Integration (LPP) (2010 – 2015) (hereinafter referred to as “LPPE”) • JICA partnership program Project for Assistance to Develop An Effective Waste Utilization System with Citizen Cooperation in Lao PDR capital Vientiane (2015 – 2018)

¹ The following additions and changes have been made to the “Objective of the project” described in the project’s ex-ante evaluation summary: (1) Adding the ASEAN Integration Roadmap for a supplementary explanation of Environmentally sustainable cities, and (2) Changing the description of the overall goal from “improvement of the urban environment” to “improvement of the hygienic environment” in the target cities in order to more specifically describe the effects of the project on solid waste collection and management.

	<p>Asian Development Bank (ADB):</p> <ul style="list-style-type: none"> • Greater Mekong Sub-region Tourism Infrastructure for Inclusive Growth Project (2014 – 2020) <p>Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ):</p> <ul style="list-style-type: none"> • Luang Prabang – Handle with Care Project (2016 – 2019)
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2. Outline of the Evaluation Study

2.1 External Evaluator

Hideyuki Takagi, Ernst & Young ShinNihon LLC

2.2 Duration of Evaluation Study

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

Duration of the study: August 2018 – November 2019

Duration of the Field Study: November 1 – December 13, 2018

3. Results of the Evaluation (Overall Rating: A²)

3.1 Relevance (Rating: ③³)

3.1.1 Consistency with the Development Plan of Laos

3.1.1.1 Consistency with the National Development Plan

The national development plan of Laos, which promotes the improvement of the urban environment based on the concept of environmental considerations, coincided with both ex-ante and ex-post evaluations. At the time of the ex-post evaluation, agencies involved in the plan were working to further improve the urban environment, setting the target number of cities recognized as Environmentally Sustainable Cities (hereinafter referred to as “ESCs”).

In the 7th *National Socio-economic Development Plan 2011-2015* and the *National Environmental Strategy 2020 (2004-2020)* which both coincided with the ex-ante evaluation, priority was given to sustainable economic and social development in consideration for the environment. Similarly, the 8th *National Socio-economic Development Plan 2016-2020* which coincided with the ex-post evaluation promotes a policy guideline that aims to balance economic growth and the urban environment. In addition, the improvement of the urban environment has been more strongly emphasized since it is one of the targets of the sustainable development goals (SDGs), and ASEAN aims to recognize at least 10 cities as ESCs by 2020.

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

³ ③: High, ②: Fair, ①: Low

3.1.1.2 Consistency with the Sector Development Plan

At the time of both the ex-ante evaluation and ex-post evaluation, enhancing waste management capabilities in the target cities of the project was consistently promoted.

The need to strengthen waste management capacity in the target cities of the project was set out in the *Environmental Management Action Plan 2011-2015* released by the Ministry of Natural Resources and Environment (hereinafter referred to as “MoNRE”) at the time of the ex-ante evaluation. The dissemination of ESC guidelines to local cities is being further promoted in line with the goals for ESC-certified cities set out in the *8th National Socio-economic Development Plan* at the time of the ex-post evaluation. In addition, the Ministry of Public Works and Transport (hereinafter referred to as “MPWT”), an agency involved in the implementation of the project, formulated a plan for infrastructure development and environmental services for the urban environment as part of its urban development strategy *Vision to 2030 and 10-year Urban Development Strategy 2016-2025 and 4-year investment plan 2017-2020*.

The project was highly relevant to the country’s development plan both at the time of planning and ex-post evaluation.

3.1.2 Consistency with the Development Needs of Laos

The target cities of the project were selected due to an expected increase in the amount of waste generated alongside population growth as well as the fact that the waste collection rate remains low due to inefficient waste collection and transportation methods, despite these cities being positioned as ESCs in ASEAN’s integrated roadmap.

3.1.2.1 Improvement in the Waste Collection Ratio

The waste collection rate (% of population) in the target cities at the time of the ex-ante evaluation was very low. In Vientiane in particular, the rate was as low as 21%, and improvements were expected in the other two cities as well. At the time of the ex-post evaluation, the waste collection rate had significantly improved in these cities owing to the project, together with the synergies with a related technical cooperation project, LPPE, as described in “3.3 Effectiveness and Impacts.”

3.1.2.2 Countermeasures to Combat Increased Waste Generation due to Population Growth

At the time of ex-ante evaluation, the population of Vientiane was estimated to grow at a rate of 31% between 2013 and 2020 while that of the other two cities was estimated to grow

by 10% or more. Although the actual population growth rates as of 2018 were lower than the estimate for Vientiane and Luang Prabang (underlined in Table 1), growth rates for Vientiane and Xayabouri were relatively high, exceeding 10% growth in the five years since 2013.

Table 1. Population growth in the target cities

(Unit: Number of people)

City	Before Project	At the time of the ex-post evaluation				Target year (four years after project completion)	
	2013	2018				2020	
	Baseline	Estimate		Actual		Estimate	
	Population	Population	% increase	Population	% increase	Population	% increase
Vientiane	820,755	995,231	21%	<u>924,019</u>	<u>13%</u>	1,075,000	31%
Luang Prabang	86,785	94,883	9%	<u>88,385</u>	<u>2%</u>	98,330	13%
Xayabouri	71,449	77,596	9%	80,582	13%	80,200	12%
Total/Average	978,989	1,167,710	19%	1,092,986	12%	1,253,530	28%

Source: The baseline and estimates are from materials provided by JICA. The actual figures at the time of the ex-post evaluation are from materials provided by the O&M agencies.

In light of the above, the waste collection rate improved considerably as a result of the project. Meanwhile, population continues to increase in each target city, and it is necessary to perform appropriate collection and management of waste generated by urban activities. Therefore, the project was consistent with the development needs both before and after the project.

3.1.3 Consistency with Japan's ODA Policy

The project was consistent with the Japan's aid policy as described below during the planning phase of the project.

3.1.3.1 Country Assistance Policy

In *Japan's Country Assistance Policy for Laos (April 2012)*, Japan planned to provide support with an emphasis on promoting economic growth while taking into consideration factors such as the environment. Specifically, the City Environment Improvement Program in the priority area of Economic and Social Infrastructure Development states that support will be provided for the purpose of achieving balanced economic growth by contributing to the establishment of a comfortable society in harmony with the environment through measures such as environmental management, introduction of wastewater treatment plants, and urban planning. The project was implemented based on these policies.

The project has been sufficiently consistent with the development plan and development needs of Laos, as well as Japan’s ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ②)

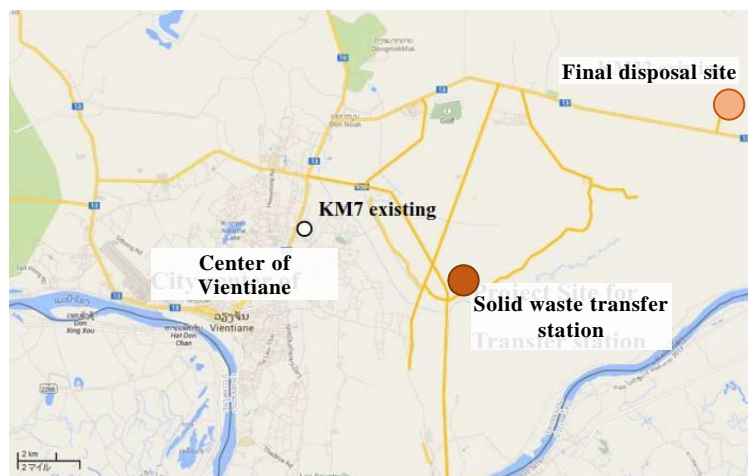
3.2.1 Project Outputs

The outputs of the project were the construction of a solid waste transfer station in Vientiane and procurement of equipment such as waste collection vehicles in the three target cities for the purpose of improving waste collection capacity and streamlining transport, consulting services related to design and construction, and technical assistance related to the operation of solid waste transfer station, etc. The project mainly covered Vientiane, which accounted for 90% of these outputs on a monetary basis.

3.2.1.1 Construction and Procurement

3.2.1.1.1 Solid Waste Transfer Station

In order to improve the efficiency of waste collection, a solid waste transfer station was constructed approximately halfway between the center of Vientiane and the final disposal site. The distance from the center of Vientiane to the solid waste transfer station is about 12 km (about 30 minutes by car), and the distance from the solid waste transfer station to the final disposal site is about 25 km (about 30 minutes by car)⁴. An efficient transportation system was established in which small collection vehicles travel around the city area and large vehicles transport waste from the solid waste transfer station to the final disposal site.



Source: Materials provided by JICA

Figure 2. Location of the solid waste transfer station in Vientiane

⁴ Each travel time is an actual measurement at the time of filed study for the ex-post evaluation.

Provided below is an outline of the facilities, which were constructed as planned. Although all outputs on the Laos side were implemented, there were some specification changes as described in “3.2.2.1 Project Cost” below.

Table 2. Outline of the solid waste transfer station

Japanese side outputs	Lao side outputs
Construction	
Transfer facility building, truck scale administration building, approach slope, car wash, restroom building, external facilities	Access road to the solid waste transfer station, electricity supply, water supply, fencing, gate
Procurement	
Two (2) drum-type storage and transfer machines	

Source: Materials provided by JICA

3.2.1.1.2 Waste Collection Vehicles, etc.

In the three target cities, waste collection vehicles, heavy machinery for the final disposal sites, etc. were provided to the O&M agencies as planned.

Table 3. List of provided waste collection vehicles, etc.

Type	Vientiane	Luang Prabang	Xayabouri
Waste collection vehicle			
Compactor truck (20m ³)	3	—	—
Compactor truck (10m ³)	16	—	2
Compactor truck (6m ³)	17	4	—
Compactor truck (6m ³ 4WD)	4	—	—
Dump truck (10m ³)	2	3	1
Skip loader (5m ³)	4	1	1
Medical waste collection vehicle	1	—	—
Heavy machinery for final disposal sites			
Bulldozer (21t)	1	—	—
Bulldozer (10t)	—	1	—
Excavator (0.6m ³)	—	—	1
Others			
Sprinkler truck	1	1	1
Vacuum car for sewage collection (6m ³)	1	—	—
Car washing machine	2	1	1

Source: Materials provided by JICA

3.2.1.2 Consulting Services and Technical Assistance

All consulting services related to design, construction and technical assistance were

implemented for the solid waste transfer station in Vientiane mostly as planned. Technical assistance in the following three categories was provided to the Urban Development Administration Authority (hereinafter referred to as “UDAA”) ⁵, an O&M agency in Vientiane.

Table 4. Technical assistance details

Category	Details
Dispatch management of the waste collection vehicles	Provide guidance to Vientiane UDAA’s waste collection service division on the development of a dispatch plan for waste collection vehicles
Operations of the solid waste transfer station	Provide guidance on the formulation of operation rules including procedures for transshipment at the solid waste transfer station, working rules, items related to safety and health, etc.
Waste disposal processing at the final disposal site	Provide guidance on the proper dumping method to the disposal site supervisor, heavy machinery operators and 20m ³ compactor truck drivers

Source: Materials provided by JICA

< Reference: Details of support and provided equipment, etc. in the related LPPE project >

i Details of support in the three target cities (applies to all three cities)

<ul style="list-style-type: none"> • Development of ESC vision • Promotion of 3R (reuse, reduce, recycle) • Improvement of waste collection system (development of waste collection plan, promotion of waste collection contracts based on the beneficiary payment principle) • Improvement of operations of final disposal site • Improvement of medical waste management • Development of a solid waste management system (agreement among stakeholders, improvement of financial system, development of related regulations and ministerial decrees, etc.)

ii Improvement of facilities and provision of vehicles and equipment in the three target cities

Item	Vientiane	Luang Prabang	Xayabouri
Improvement of waste collection system	—	Pickup truck (1) ^{*1} Large containers (5m ² x 10) and a workshop for producing containers	Materials for producing large Containers (5m ² x 10) and a workshop for producing containers
Improvement of operations of final disposal site	Improvement of access roads, etc. Excreta disposal treatment facility Bulldozer (1)	Improvement of access roads, etc. Excreta disposal treatment facility Compost plant	Improvement of access roads, etc. Excreta disposal treatment facility Backhoe loader (1)

⁵ As described in “3.4 Sustainability” below, Vientiane UDAA was renamed Vientiane City Office for Management and Services (hereinafter referred to as “VCOMS”) in 2016.

Item	Vientiane	Luang Prabang	Xayabouri
	Dump truck (2)	Truck scale Excavator (1) Dump truck (1)	Dump truck (1)
Improvement of medical waste management	A medical incinerator exclusively for infectious disease and a structure for housing the incinerator	A medical incinerator exclusively for infectious disease and a structure for housing the incinerator Pickup truck (1) ^{*1}	A disposing facility for infectious medical waste (pit type) Improvement of a skip loader (1) Containers for medical waste (2)

Source: Materials provided by JICA (both of the reference i and ii above)

^{*1} Used for transportation of both offsite compost⁶ and medical waste

3.2.2 Project Inputs

3.2.2.1 Project Cost

For the inputs of the Project, the total project cost slightly exceeded the plan at 102% of the planned amount (the project cost was 94% of the planned amount on the Japanese side, and 243% of the planned amount on the Lao side). As shown in Table 6, the main factor for the increase in project costs on the Lao side was a change in specifications aimed at improving the durability of an access road.

Table 5. Comparison of planned and actual project cost

(Unit: Million Yen)

Item	Plan	Actual	% of the plan
Japanese side	1,384	1,303	94
Lao side	83	202	243
Total project cost	1,467	1,505	103

Source: Materials were provided by JICA for the planned costs on both sides and the actual cost on the Japanese side, and by the executing agency for the actual cost on the Lao side.

Table 6. Breakdown of actual costs on the Lao side

(Expenditures related to the construction of a solid waste transfer station in Vientiane)

Item	Plan	Actual	Actual	Main factor for the difference
	Million Laos Kip		Million Yen ^{*1}	
Access road	4,158	11,844	168	Change in specification of pavement from asphalt to concrete in consideration of durability, and widening of road width from 6m to 8m

⁶ Composting activities take place at a site that is distant from the source. In LPPE, organic fertilizers are produced from kitchen garbage collected from hotels, restaurants, etc. at facilities on the premises of the Luang Prabang final disposal site.

Item	Plan	Actual	Actual	Main factor for the difference
	Million Laos Kip		Million Yen*1	
Leading power line	782	1,097	16	Change to a large transformer considering the volume of power consumption
Constructing water supply pipes	78	404	6	Change to a large diameter water pipe considering the volume of water consumption
Fencing	78	637	9	Change in material considering durability
Gate	16	31	0	—
Planting (buffer zone)	39	75	1	—
Administrative expenses	-	150	2	—
Total	5,150	14,239	202	

Source: Materials were provided by JICA for the plan and by the executing agency for the actual.

*1 The average exchange rate during the project period is used for conversion.

3.2.2.2 Project Period

The project period was from April 2014 to January 2016 (22 months), accounting for 100% of the plan. The following is a comparison between the planned and actual project period for each process.

Table 7. Comparison of planned and actual project period

Process	Plan	Actual	Note
Detail designing	Mid. April – mid. July 2014 (3 months)	April 3 – mid. of May, 2014 (2 months)	—
Bidding and contract	September 4, 2014 – December 17, 2016 (4 months)	June 23 – September 4, 2014 (4 months)	—
Main construction work	November 2014 – end of December 2015 (14 months)	November 5, 2014 – December 17, 2015 (14 months)	Including initial operation instructions
Completion of construction work – completion of the project (Completion of construction work – completion of technical assistance)	End of December 2015 – mid. to end of January 2016 (1 month)	December 17, 2015 – January 29, 2016 (1 month)	Completion is defined as the start of operations. Vehicles and heavy machinery: Delivery was completed in November 2015. Solid waste transfer station: Trial operation started from the completion ceremony on January 29, 2016, and official operations started in March of the same year.

Source: Materials provided by JICA

Although the project period was within the plan, project costs exceeded the plan. Therefore, efficiency of the project is deemed to be fair.

3.3 Effectiveness and Impacts⁷ (Rating: ③)

The construction of facilities and provision of vehicles and equipment related to this project were carried out based on the waste collection plan that was formulated with the support of LPPE referenced in “3.2.1 Project Outputs.” As described in that section, outputs such as improvement of facilities and provision of vehicles and equipment to the three target cities had been made through LPPE as well. In other words, these two projects are mutually complementary. Therefore, the following effectiveness and impact are recognized as not only resulting from the project but also from the synergies with LPPE.

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

3.3.1.1.1 Operation Indicators

As there were no operation indicators set in the ex-ante evaluation, the external evaluator set the following operation indicators upon carrying out this ex-post evaluation: operating ratio of procured vehicles and heavy machinery in the three target cities and the number of trips per day between the solid waste transfer station and the final disposal site in Vientiane⁸ (refer to 4.3 Lessons Learned below). The target operating ratio of procured vehicles and heavy machinery was set as N/A in consideration of the possibility that not all vehicles needed to be operated as of the ex-post evaluation since only the necessary number of collection vehicles were provided for waste collection activities in line with the assumed amount of waste as of 2020. The target number of trips per day between solid waste transfer station and final disposal site was assumed to be 9 trips per day at maximum (3 large compactor trucks (20m³) x 3 times) which has been assumed based on the technical assistance provided as part of the project.

⁷ Sub-rating for Effectiveness is to be performed with consideration to Impacts.

⁸ Number of times waste was transferred from the solid waste transfer station to the final disposal site. Waste being transported one time is defined as one trip.

Table 8. Comparison of operation indicator targets and actual values

	Baseline	Target	Actual	
	2013	2016	2016	2018
		Completion Year	Completion Year	As of Ex-post Evaluation
Indicator 1. Operating ratio of provided vehicles and heavy machinery				
Vientiane	N/A	N/A	100%	100%
Luang Prabang	N/A	N/A	100%	100%
Xayabouri	N/A	N/A	100%	100%
Indicator 2. The number of trips per day between the solid waste transfer station and the final disposal site	N/A	9	8	8 - 9

Source: Materials were provided by JICA for the baseline and target, and by the O&M agencies for the actual.

3.3.1.1.1.1 Operating Ratio of Provided Vehicles and Heavy Machinery

In the three target cities, all of the provided vehicles are in operation and are used for waste collection and disposal. Since in Vientiane, number of vehicles were provided by the project, it was assumed that the vehicles were being used in rotation⁹ to maintain their condition as of 2018, when the ex-post evaluation was carried out. The provided vehicles have been in full operation; accordingly, waste collection exceeding the target has been achieved.

3.3.1.1.1.2 Number of Trips per Day between the Solid Waste Transfer Station and the Final Disposal Site

The solid waste transfer station constructed in Vientiane has been operating as planned as the maximum number of trips per day using the provided vehicles has mostly been achieved and maintained at the maximum of 9 trips (3 vehicles x 3 times).

In the light of above, the operation level of the project outputs is high, thus resulting in the planned effects.

⁹ Vehicle parts will begin to deteriorate if the vehicles are left unused for a long period of time. Therefore, it was suggested at the time of defect inspection that all vehicles be used in rotation.



Photo 2. Solid waste transfer station in Vientiane (compactor trucks and skip loaders on standby after waste collection for the day)



Photo 3. Same as left (Transshipment of waste to a large (20m³) compactor truck that transports waste to the final disposal site)

3.3.1.1.2 Effect Indicators

The external evaluator set volume of waste collected per staff (t/day/person, average) as an effect indicator in addition to volume of waste collected (t/day, average), which had been set in the summary report of the ex-ante evaluation of the project, to complement the analysis of the degree of improvement in waste collection efficiency resulting from the construction of a facility and the provision of equipment. The target for the newly added indicator, volume of waste collected per staff, was set based on the target for the volume of waste collected and the assumed number of staff required for the waste collection work at the time of planning. The comparison of targets and actual values for the effect indicators is as follows.

Table 9. Comparison between effect indicator targets and actual values

	Baseline	Target		Actual		
	2013	2018	2020	2016	2017	2018
		2 Years After Completion	4 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion
Indicator 1. Volume of waste collected (t/day, average)						
Vientiane	69.3	174.6* ¹	259.3	178.0	204.0	217.0
Luang Prabang	20.6	32.1* ¹	39.4* ²	23.1	28.0	29.6
Xayabouri	19.2	31.0* ¹	39.1	28.4	28.4	28.9
Indicator 2. Volume of waste collected per staff (t/day/person, average)						
Vientiane	0.7	N/A	0.9	1.3	1.4	1.3
Luang Prabang	1.7	N/A	1.2	0.9	1.1	1.0
Xayabouri	1.6	N/A	1.2	1.1	1.1	1.0

Source: Materials were provided by JICA for the baseline and target, and by the O&M agencies for the actual.

*1 The evaluator calculated the target for 2018 based on forecasts used in setting the target for 2020 at the time of planning (change in population, waste collection rate (government services), rate of increase in waste generation per capita).

*2 As it was confirmed that the target for Luang Prabang for 2020 (54.4) stated in the summary report of the ex-ante evaluation was miscalculated, the target was recalculated and replaced in this ex-post evaluation. The replaced number was calculated by the evaluator based on waste generation per capita forecast at the time of the ex-ante evaluation.

3.3.1.1.2.1 Volume of Waste Collected (t/day, average)

In the summary report of the ex-ante evaluation report on the project, the 2020 target for this indicator was calculated based on population forecasts. Therefore, the evaluator calculated the figure for 2018 as of the ex-post evaluation and set it as the target for this ex-post evaluation. The degree of achievement of the target was verified by comparing the rate of increase from the baseline to the target and to the actual value from 2013 to 2018 for each city (Similarly, rate of increase comparisons were used to calculate the 2018 target for the impact indicators “population covered by waste collection services” and “waste collection rate”). As shown below, Vientiane greatly exceeded the target, Luang Prabang fell somewhat short of the target at 79%, and Xayabouri mostly achieved the target at 82%¹⁰.

Vientiane	The actual was 217.0 t/day (actual increase rate of 213%) compared to the target of 174.6 t/day (target increase rate of 152%). Target achievement in terms of increase rate was 140%.
Luang Prabang	The actual was 29.6 t/day (actual increase rate of 44%) compared to the target of 32.1 t/day (target increase rate of 56%). Target achievement in terms of increase rate was 79%.
Xayabouri	The actual was 28.9 t/day (actual increase rate of 50%) compared to the target of 31.0 t/day (target increase rate of 61%). Target achievement in terms of increase rate was 82%.

3.3.1.1.2.2 Volume of Waste Collected per Staff (t/day/person, average)

It was determined that the target was achieved in Vientiane and mostly achieved in Luang Prabang and Xayabouri. In Vientiane in particular, the volume of waste collected per staff increased significantly beyond the target.

In the view of the evaluator, considering that the amount of waste collected per staff is nearly the same at around 1 t/day in all three cities as of the ex-post evaluation, an appropriate number of staff has been secured in all three cities under operations not relying on government subsidies, therefore indicating that waste collection operations have been

¹⁰ “Mostly achieved” indicates achievement of 80% or more of the target.

efficient. In addition, it is observed that the collection efficiency is somewhat high in Vientiane where a solid waste transfer station is in operation. This indicates that waste collection efficiency is improving through utilization of a solid waste transfer station.

3.3.1.2 Qualitative Effects (Other Effects)

Based on the details of the outputs of the project, the evaluator added “reduction of uncollected waste at the waste collection point” as a qualitative effect indicator to verify improvements in hygiene conditions, which was raised in the summary report of the ex-ante evaluation of the project. In addition, the evaluator also added “reduction of danger during transshipment of waste” as an indicator to analyze the reduction of hazards in connection with work related to the implementation of the project, considering the danger involved in the transshipment of waste at a workshop in Vientiane prior to the project. The status of these indicators as of the ex-post evaluation was as follows.

3.3.1.2.1 Reduction of Uncollected Waste at the Waste Collection Point

According to the O&M agencies, increased use of small collection vehicles has made it possible to adequately cover collection points deep within residential areas in all three target cities. Therefore, uncollected waste, which was previously left at collection points, has nearly been eliminated. According to interviews with residents during site visits¹¹, this reduction has, in effect, improved situations in which animals (e.g., dogs) scatter uncollected waste. Accordingly, the occurrence of the effect associated with this indicator is deemed to be high.

3.3.1.2.2 Reduction of Danger during Transshipment of Waste¹²

According to the O&M agency of Vientiane, utilization of the newly constructed solid waste transfer station has reduced danger as the need for outdated transshipment work has been eliminated. Therefore, the occurrence of the effect associated with this indicator is deemed to be high.

The utilization of the vehicles, heavy machinery and solid waste transfer station provided by this project has been high; thus, the target waste collection volume has generally been achieved in the three target cities. In these areas where waste collection has improved,

¹¹ In the three target cities, interviews were conducted mainly with residents of the LPPE pilot sites and with public institutions such as village offices, schools, hospitals, and markets (approx. 10 people in each city).

¹² Before the implementation of the project, container waste collected by skip loaders was transhipped into dump trucks for transportation to the final disposal site. Such transshipment work was dangerous because it used outdated equipment to hang containers high.

uncollected waste has been reduced as a result. Therefore, the occurrence of effects associated with this project is deemed to be high.

3.3.2 Impacts

3.3.2.1 Intended Impacts

3.3.2.1.1 Quantitative Impact Indicators

In addition to population covered by government waste collection services (persons) set in the summary report of the ex-ante evaluation, the evaluator set waste collection rate (% of population) as a quantitative impact indicator for this project to determine the extent to which the project has contributed to improving development issues. The target of the added waste collection rate (% of population) indicator was the assumption during the planning phase, based on population forecasts and target waste collection volume. The comparisons of indicator targets and actual values are as follows.

Table 10. Comparison of quantitative impact indicator targets and actual values

	Baseline	Target		Actual		
	2013	2018	2020	2016	2017	2018
		2Yyears After Completion	4 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion
Indicator 1. Population covered by government waste collection services (persons)						
Vientiane	70,495	145,301 ^{*1}	199,596	261,902	322,514	383,125
Luang Prabang	33,362	42,526 ^{*1}	48,319	35,872	37,951	38,760
Xayabouri	31,099	41,100 ^{*1}	47,594	43,516	45,845	46,709
Indicator 2. Waste collection rate (% of population)						
2-1 Collection rate (government services) (%)						
Vientiane	8.6	14.6 ^{*2}	18.6	30.9	35.5	41.5
Luang Prabang	38.4	44.8 ^{*2}	49.1	40.9	43.2	43.9
Xayabouri	43.5	53.0 ^{*2}	59.3	55.6	57.5	58.0
2-2 Overall collection rate (including private collectors) (%)						
Vientiane	20.5	34.2 ^{*3}	40.4	72.1	73.9	79.6
Luang Prabang	68.4	74.8 ^{*3}	79.1	72.1	75.0	76.6
Xayabouri	51.4	60.9 ^{*3}	67.2	63.1	65.5	66.6

Source: Materials were provided by JICA for the baseline and target, and by the O&M agencies for the actual.

*1 Calculated by the evaluator based on the assumptions (change in population, waste collection rate

(government services)) used in setting 2020 targets during the planning stage.

*2 Same as the above. Calculated by the evaluator based on the assumed waste collection rate (government services).

*3 Same as the above. Calculated by the evaluator based on the assumed waste collection rate (government services and private collectors).

3.3.2.1.1.1 Population Covered by Government Waste Collection Services (persons)

The targets were achieved in Vientiane and Xayaburi and were achieved to some extent in Luang Prabang as described below.

Vientiane	The actual was 383,125 persons (actual increase rate of 443%) compared to the target of 145,301 persons (target increase rate of 106%). Target achievement in terms of increase rate was 418%.
Luang Prabang	The actual was 38,760 persons (actual increase rate of 16%) compared to the target of 42,526 persons (target increase rate of 27%). Target achievement in terms of increase rate was 59%.
Xayabouri	The actual was 46,709 persons (actual increase rate of 50%) compared to the target of 41,100 persons (target increase rate of 32%). Target achievement in terms of increase rate was 156%.

Note that this indicator is calculated based on the population growth rate and the waste collection rate (government services) in each city. As such, the degree of achievement of the target is influenced by the actual values corresponding to the factors used in such calculation. The reason why the achievement level of Luang Prabang was much lower than that of Xayabouri, despite having a similar target increase rate of about 30%, is due to both of the following factors: (1) the population growth rate of Luang Prabang was much lower than expected at the time of planning as described in “3.1.2.1 Improvement in the waste collection ratio,” and (2) there was a difference in the degree of achievement of waste collection rate (government services) (% of population) as described below.

3.3.2.1.1.2 Waste Collection Rate (% of population)

Indicator 2-1 Collection rate (government services) (%)

The targets were achieved in Vientiane, Luang Prabang and Xayabouri as described below.

Vientiane	The actual was 41.5% (actual increase rate of 383%) compared to the target of 14.6% (target increase rate of 70%). Target achievement in terms of increase rate was 547%.
Luang Prabang	The actual was 43.9% (actual increase rate of 14%) compared to the target of 44.8% (target increase rate of 17%). Target achievement in terms of increase rate was 82%.
Xayabouri	The actual was 58.9% (actual increase rate of 33%) compared to the target of 53.0% (target increase rate of 22%). Target achievement in terms of increase rate was 150%.

Indicator 2-2 Overall collection rate (including private collectors) (%)

The targets were achieved in Vientiane, Luang Prabang and Xayabouri as described below.

Vientiane	The actual was 79.6% (actual increase rate of 312%) compared to the target of 34.2% (target increase rate of 67%). Target achievement in terms of increase rate was 466%.
Luang Prabang	The actual was 76.6% (actual increase rate of 12%) compared to the target of 74.8% (target increase rate of 9%). Target achievement in terms of increase rate was 133%.
Xayabouri	The actual was 66.6% (actual increase rate of 30%) compared to the target of 60.9% (target increase rate of 18%). Target achievement in terms of increase rate was 167%.

3.3.2.1.2 Qualitative Impact Indicators

Considering the effects expected to result from implementation of the project, the evaluator added “reduction of foul odor and/or pests around residential areas,” “reduction of illegal waste dumping in the city” and “satisfaction of residents with waste collection” as qualitative impact indicators to verify improvements in hygiene conditions, which was raised in the summary report of the ex-ante evaluation of the project. The status of these indicators as of the ex-post evaluation was as follows.

3.3.2.1.2.1 Reduction of Foul Odor and/or Pests around Residential Areas

According to the O&M agencies in the three target cities, a major reduction in foul odor and pests around residential areas has been observed after implementation of the project,

mainly as a result of the introduction of the compactor trucks as described in “satisfaction of residents with waste collection” below. In addition, according to interviews with residents during site visits, the problem of waste water from collection vehicles remaining on the streets in particular has been improved. Accordingly, the occurrence of the effect associated with this indicator is deemed to be high.

3.3.2.1.2.2 Reduction of Illegal Waste Dumping in the City

Before implementation of the project when there was a low number of waste collection contracts, waste was disposed of by non-contracted households in a way that did not comply with laws and regulations, such as incineration in the yard of the home or dumping in vacant lots and riverbeds. Due to related projects such as LPPE (especially development of collection plans and promotion of collection contracts) and implementation of the project, collection contracts¹³ between local governments and residents are increasing in all three target cities. With regards to this effect, according to the O&M agencies, synergies with LPPE have also led to a reduction in illegal dumping.

3.3.2.1.2.3 Satisfaction of Residents with Waste Collection

According to the executing agency, the introduction of compactor trucks in particular has made it possible to carry out waste collection more cleanly, as waste water from waste collection vehicles does not remain on the road compared to the previous method of waste collection with dump trucks. Although satisfaction surveys were not conducted in any of the three target cities, complaints from residents related to the above issues have decreased according to the O&M agencies. In Vientiane, complaints by direct mail and letters regarding waste collection have fallen yearly from the 30 to 40 cases per month reported before project implementation, and were almost non-existent at the time of the ex-post evaluation. Accordingly, the occurrence of the effect associated with this indicator is deemed to be high.

3.3.2.2 Other Positive and Negative Impacts

3.3.2.2.1 Impact on the Natural Environment

According to the executing agency, inspection results of waste water from washing collection vehicles are submitted to MoNRE, and environmental pollution inspections are conducted by the Department of Natural Resources and Environment of Vientiane to monitor the environmental impact of the Vientiane solid waste transfer station. Negative impacts on the environment have not been observed for the other project items.

¹³ In the three target cities, waste is collected only from residents and businesses who pay the waste collection fees. Waste collection fee income is used to cover the costs of waste collection.

The results of the water quality inspection submitted to MoNRE are as follows. According to the results, the water quality of the waste water meets the national standards.

Table 11. Results of the water quality inspection of waste water from washing waste collection vehicles (2017)

Inspection item	Unit	Inspection result			National waste water standard	
		No. 1	No. 2	No. 3		
1	BOD*1	Mg/L	17	1	1	30 - 60
2	COD*2	Mg/L	33	1	1	120 - 400
3	TSS*3	Mg/L	39	2	4	50 - 150
4	Pb (Lead)	Mg/L	0.03	0.11	0.26	0.2
5	Zn (Zinc)	Mg/L	<0.5	<0.5	<0.5	5
6	Fe (Iron)	Mg/L	<0.5	<0.5	<0.5	—

Source: O&M agency

Note: No. 1 in the inspection result breakdown is waste water from washing collection vehicles, No. 2 is water from a well on the premises of the solid waste transfer station, and No. 3 is water from a well near the solid waste transfer station. In addition, regarding the lead concentration of No. 3 which slightly exceeds the waste water standard, it is assumed to be caused by other factors in the water collection area, since the waste water from washing collection vehicles, which is the environmental burden caused by the project, is below the standard.

*1: Biochemical oxygen demand, *2: Chemical oxygen demand, *3: Turbidity

3.3.2.2.2 Resettlement and/or Land Acquisitions

The construction of the solid waste transfer station in accordance with the project was carried out on land owned by the government of Vientiane. At the time of the ex-ante evaluation, it was confirmed that land related to the livelihood of local residents was not used. In this ex-post evaluation, it was once again confirmed by the executing agency that no resettlement has occurred due to the implementation of the project and, accordingly, the livelihoods of residents have not been negatively impacted by factors such as resettlement. At the field study, it was confirmed that, of the residential areas around the solid waste transfer station, none face the potential of their residents' livelihoods being affected.

3.3.2.2.3 Other Impacts

3.3.2.2.3.1 Other Positive Impacts

Contribution to the promotion of tourism by beautifying the cityscape: According to the executing agency, it is recognized that tourism is an important industry in all three target cities, and landscape beautification of urban areas resulting from improvement of waste collection contributes to tourism promotion. In Luang Prabang in particular, the effect of the project on improving waste management contributes to the city maintaining its designation as a World Heritage Site according to the O&M agency.

3.3.2.2.3.2 Other Negative Impacts

Development of the next final disposal site: In all three target cities, the volume of waste collected has increased as a result of the project, and it is expected that the landfills at the final disposal sites in Luang Prabang and Xayabouri will be full in a few years (the final disposal site in Vientiane has a landfill that can still be used for another 10 to 14 years). Therefore, despite the urgent need to develop the final disposal sites in Luang Prabang and Xayabouri, securing the necessary budget is an issue (refer to “4.2.1 Recommendations to the Executing Agency” below).

< Weighting of effectiveness and impact sub-ratings >

In light of the details and scale of the project outputs, quantitative effect indicators were given significant weight while impact indicators were given less weight in the sub-ratings. In addition, the highest priority among the quantitative effects indicators was given to the increase in Vientiane's waste collection volume, which accounts for a majority of the project's output.

The project has achieved its objectives. Therefore the effectiveness and impacts of the project are both high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional / Organizational Aspects of Operation and Maintenance

3.4.1.1 Institutions related to Environmentally Sustainable Cities

Environmentally Sustainable Cities, which is the institutional basis of the project, was established by MoNRE, the responsible ministry. MoNRE plans to continue strengthening cooperation with related organizations and making efforts to disseminate ESC guidelines. Each city has begun to put urban environment improvements into practice through the Department of Natural Resources and Environment, covering all aspects of urban greening and beautification including waste management based on “Green, Clean and Beautiful Laos,”¹⁴ a concept set forth in the ESC Guidelines. Similarly, MPWT is promoting environmentally sustainable cities in terms of both infrastructure development and environmental services for urban environments.

3.4.1.2 Organizations for Waste Collection and Management

Waste collection and management is conducted by UDAA, an O&M agency in each target

¹⁴ A strategic vision of LPP, a related JICA technical cooperation project, which has been taken up in the ESC guidelines as a concept of “maintaining an environment that does not harm people's health and ecosystem, thereby connecting healthy and rich urban life to the next generation.”

city. Although the name of Vientiane's UDAA was changed to Vientiane City Office for Management and Service (VCOMS) in 2016, there has been no change in its organizational structure, responsibilities, or operations.

According to the O&M agencies in Vientiane, Luang Prabang and Xayabouri, a sufficient number of trained personnel have been secured as part of an organization for waste collection and management. Further, the following changes in the number of personnel engaging in waste collection and management at each O&M agency indicate that the organization has been improved compared to before the project was implemented.

Table 12. Changes in the number of waste collection and disposal staff

(Unit: Persons)

City / Item	Before Project	Completion Year		As of Ex-post Evaluation
	2013	2016	2017	2018
Vientiane				
Collection vehicle drivers	25	44	50	57
Waste collection staff	75	92	94	106
Heavy machinery operators	1	2	2	3
Luang Prabang				
Collection vehicle drivers	3	10	8	9
Waste collection staff	9	20	18	21
Heavy machinery operators	1	2	2	2
Xayabouri				
Collection vehicle drivers	4	4	8	9
Waste collection staff	12	10	18	21
Heavy machinery operators	1	2	2	2

Source: Materials were provided by JICA for the data before the project, and by the O&M agencies for the data after project completion.

In addition to the above, the O&M agency in Vientiane has hired staff to operate the newly constructed solid waste transfer station. At the time of the ex-post evaluation, the number of staff is one supervisor, one truck scale operator, and two drum storage system operators. According to the O&M agency, a sufficient number of personnel has been secured.

Based on the above, there are no particular problems related to institutional and organizational aspects of the operation and maintenance system.

3.4.2 Technical Aspects of Operation and Maintenance

3.4.2.1 Technical Capabilities of the Executing Agency related to Environmentally Sustainable Cities

The staff of the Department of Housing and Urban Planning (hereinafter referred to as “DHUP”) of MPWT are implementing projects supported by ADB in addition to LPPE, and have educational backgrounds in urban environment; therefore, they have the ability to

manage urban environment based on the ESC guidelines. DHUP hires new staff every year. In addition to the above, technical staff train newly hired non-technical staff to improve their technical skills related to the ESC guidelines.

3.4.2.2 Technical Skills of O&M Agencies related to Waste Collection and Management

In the implementation of the project, technical assistance was given to the O&M agency in Vientiane by providing its staff with training and manuals on the operation of the solid waste transfer station as well as maintenance of the provided vehicles and heavy machinery. For the O&M agencies in Luang Prabang and Xayabouri, staff were provided with training and manuals on maintenance of vehicles and heavy machinery. According to the O&M agencies, in the three target cities, the method of operation and maintenance trained through the project has been shared among staff members and continued, and the provided manuals have been utilized. The manuals for the provided vehicles and heavy machinery are referred to as necessary during maintenance. In Vientiane, where there is a large amount of work and many staff members at the solid waste transfer station, internal training related to handling and maintenance of vehicles and equipment is provided to newly hired staff. In addition, the staff members hold a monthly meeting to maintain and improve their technical skills and discuss operational issues and countermeasures.

Based on the above, there are no particular problems related to technical aspects of the operation and maintenance system.

3.4.3 Financial Aspects of Operation and Maintenance

3.4.3.1 Elimination of Reliance on the Government Budget Allocation for Waste Management

Prior to the implementation of the project, the balance of receipts and expenditures related to waste management at the O&M agencies was such that waste collection fee income covered around 50 to 70% of expenditures, and the remaining amount of expenditures was mainly covered by the central and local government budgets. As of the ex-post evaluation, the operation and maintenance budget for waste management was virtually covered by the waste collection fee income in each target city. As a result, the financial status of these O&M agencies does not depend on subsidies. The main factors contributing to their current financial status were the following achievements: the realization of financially sustainable waste collection fees through support for institution building by LPPE, which is a related technical cooperation project, and the improvement of collection efficiency through the project, thus leading to an increase in collection contracts.

Daily maintenance costs including replacement of consumable parts¹⁵ for facilities, equipment and vehicles provided by the project have been covered by waste collection fee income. According to the O&M agencies, there has not been a need for major repairs because the equipment and vehicles provided are still new. When breakdown happens, as with other existing old vehicles, etc., repairs will be made when the budget is secured. If repair costs are high, budget shortages might occur. During fiscal years in which budget shortages arises, waste will be collected using vehicles that are operable.

The rates of waste collection fees in each target city (as of November 2018) are as follows.

Vientiane	20,000 to 40,000 Kip/household/month, depending on the amount of waste (approximately 260 to 520 yen at the conversion rate as of November 2018).
Luang Prabang	20,000 Kip/household/month (approximately 260 yen at the conversion rate as of November 2018).
Xayabouri	10,000 Kip/household/month (approximately 130 yen at the conversion rate as of November 2018).

3.4.3.2 Change in Balance of Receipts and Expenditures related to Waste Management in each Target City

The balance of receipts and expenditures related to waste management in each target city is as follows. After the implementation of the project, collection fee income has mostly covered expenditures, and there is no significant deficit on the balance.

¹⁵ Consumable parts include conveyor belts for drum-type storage and transfer equipment at the solid waste transfer station, as well as tires and oil, etc. for collection vehicles.

Table 13. Change in the income and expenses related to waste management in the target cities

(Unit: Thousand Laos Kip)

Vientiane

Item		Before Project	Completion Year	As of Ex-post Evaluation	
		2012	2016	2017	2018
Income	Budget allocation from the Central Government	100,000	300,000	150,000	0
	Budget allocation from Vientiane city	3,500,000	0	0	0
	Income from waste collection and carried-in waste	6,365,016	11,937,900	13,637,817	16,401,726
	<i>(% of income to total expenses)</i>	<i>62 %</i>	<i>108 %</i>	<i>104 %</i>	<i>100%</i>
Total income		9,965,016	12,237,900	13,787,817	16,401,726
Expense	Waste collection expense	5,343,109	6,921,900	8,933,819	9,983,120
	Road cleaning expense	3,500,000	3,131,500	3,000,848	4,657,457
	Final disposal site operation expense	652,376	555,842	667,879	956,952
	Administrative expenses	750,000	450,789	545,835	745,163
	Total expenses	10,245,485	11,060,031	13,148,381	16,342,692
Surplus (deficit)		(280,469)	1,177,869	639,436	59,034
<i>(% of surplus (deficit) to total expenses)</i>		<i>(3 %)</i>	<i>11 %</i>	<i>5 %</i>	<i>0%</i>

Source: Materials were provided by JICA for the data before the project, and by the O&M agencies for the data after project completion (the same applies to the other target cities below).

Luang Prabang

Item		2012	2016	2017	2018
Income	Budget allocation from the Central Government	435,000	0	0	0
	Budget allocation from Vientiane city	100,000	0	0	0
	Other subsidies	237,574	0	0	0
	Income from waste collection and carried-in waste	1,201,857	2,732,944	2,769,464	2,018,973
	<i>(% of income to total expenses)</i>	<i>65 %</i>	<i>105 %</i>	<i>104 %</i>	<i>105%</i>
Total income		1,974,431	2,732,944	2,769,464	2,018,973
Expense	Waste collection expense	677,809	710,439	756,835	864,993
	Road cleaning expense	364,973	388,989	421,000	502,305
	Final disposal site operation expense	85,800	395,812	76,262	55,450
	Administrative expenses	720,000	1,106,402	1,408,634	500,460
	Total expenses	1,848,582	2,601,642	2,662,731	1,923,208
Surplus		125,849	131,302	106,733	95,765
<i>(% of surplus to total expenses)</i>		<i>7 %</i>	<i>5 %</i>	<i>4 %</i>	<i>5%</i>

Note: Income decreased in 2018 as a result of authorities closing approximately 100 restaurants in tourist spots along the Mekong and Nam Khan rivers for violating World Heritage City rules. Administrative expenses in 2018 fell as a result of efforts by the O&M agency to reduce unnecessary spending in light of declining revenues (based on an interview with the O&M agency).

Xayabouri

Item		2012	2016	2017	2018
Income	Income from waste collection and carried-in waste	866,206	1,077,431	940,207	1,036,692
	<i>(% of income to total expenses)</i>	83 %	91 %	99 %	103%
Total income		866,206	1,077,431	940,207	1,036,692
Expense	Waste collection expense	301,249	322,698	336,648	344,060
	Road cleaning expense	54,000	62,400	60,500	65,078
	Final disposal site operation expense	36,000	349,872	361,120	350,470
	Other	342,346	187,462	62,128	112,200
	Administrative expenses	309,792	266,750	132,867	135,000
Total expenses		1,043,387	1,189,182	953,263	1,006,808
Surplus (deficit)		(177,181)	(111,751)	(13,056)	29,884
<i>(% of surplus (deficit) to total expenses)</i>		<i>(17 %)</i>	<i>(9 %)</i>	<i>(1 %)</i>	<i>3%</i>

Note: Xayabouri had been allocated government budget until 2011, but has not received it since 2012.

Based on the above, there are no particular problems related to financial aspects of the operation and maintenance system.

3.4.4 Status of Operation and Maintenance

The operation and maintenance of the solid waste transfer station constructed in Vientiane and the vehicles, heavy machinery, etc. provided to the three target cities are being appropriately carried out, and are maintained in good conditions.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project was implemented to improve waste collection and transportation efficiency in the capital city of Vientiane, the Luang Prabang district and the Xayabouri district, which are positioned as ESCs in the ASEAN integration roadmap for Laos, by constructing a solid waste transfer station and providing equipment related to solid waste management such as waste collection vehicles, thereby contributing to the improvement of the hygienic environment in these cities.

The project has been sufficiently consistent with the development plan and development needs of Laos, as well as Japan's ODA policy. Therefore, it is highly relevant to Laos' development plan and needs as well as Japan's ODA policy. Although the outputs of the project and the project period were mostly in line with plans, project costs slightly exceeded the plan. Therefore, the efficiency of the project is deemed to be fair. The target volume of

waste collected has mostly been achieved in the three target cities. Improvements were most significant in Vientiane where the majority of the project output was accounted for. As a result, the waste collection rate, defined as the development need of the project, has significantly improved in the three target cities. Based on this observation, the effects of the projects were mostly achieved as planned; therefore, the project is deemed to be highly effective and have a strong impact. The institutional and organizational aspects of environmental management have been developed, and no major problems have been observed with regards to the technical and financial aspects of the urban development administration agencies, which are the O&M agencies involved in the project. In addition, the facility and vehicles provided through the project have been maintained in good condition. Therefore the project's effects are deemed to be highly sustainable.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

4.2.1.1 Cooperation between Central and Local Governments for the Development of the Next Final Disposal Sites

As noted above in “3.3.2.2.3.2 Other Negative Impacts,” procedures are underway for the development of the next final disposal sites for the three target cities. In these cities, candidate sites for the next final disposal sites are currently being identified and development plans are being formulated; however, securing the budget for the project has been an issue. According to MPWT, studies are being conducted in Vientiane on both the development plan and construction and operation by private companies (Build Operation Transfer (BOT), etc.), in consideration of the budgetary constraints of the central and local governments. With regard to Luang Prabang and Xayabouri, where there is an urgent need to develop the next final disposal sites, it is desirable to proceed with the study in order to secure the project budget and to utilize the aforementioned method to successfully develop the final disposal sites. It is recommended that the central government cooperate with each city to address this financial issue and provide the necessary support in terms of information sharing, planning and implementation.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

4.3.1 Setting of Operation Indicators to measure the Utilization Status of Facilities and Equipment

As noted above in “3.3.1.1.1 Operation Indicators” for quantitative effects, there were no indicators set for measuring the operational status of the project's output in the summary report of the ex-ante evaluation of the project. Therefore, the following operation indicators were set for conducting the ex-post evaluation: the operating ratio of collection vehicles and heavy machinery provided to the three target cities in this project and the number of trips per day between the solid waste transfer station constructed in Vientiane and the final disposal site. In the ex-ante evaluation of future projects wherein facilities and equipment are provided, it is desirable to set operation indicators to measure the utilization status and share these with the executing agency so that the indicators are used for monitoring at the project implementation stage and upon ex-post evaluation.