

Republic of Cuba

FY 2017 Ex-Post Evaluation of Technical Cooperation Project

“Improvement of the Capacity on Urban Solid Waste Management in Havana City”

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

0. Summary

The technical cooperation project entitled “Improvement of the Capacity on Urban Solid Waste Management in Havana City” (hereinafter referred to as “the Project”) was implemented with the Project Purpose “to strengthen capacity of DPSC (*Dirección Provincial de Servicios Comunes* / Provincial Direction of Communal Services; hereinafter referred to as “DPSC”) on urban solid waste management in Havana City through collaboration among cooperative organizations.” and the Overall Goal “to properly implement urban solid waste management in Havana City and improve the city’s sanitary environment”¹. The importance of solid waste management within the policies and development needs of Cuba and Havana City was high both at the time of planning and the time of completion of the Project. The Project was relevant to Japan’s ODA policy at the time of planning. Based on the above, the relevance of the Project is high. As a result of the strengthening of collaboration among related agencies, strengthening of solid waste management capacity, the pilot project for composting, strengthening of vehicle maintenance workshop capacity, improvement in the design of a new final disposal site, and improvement in the operation of existing final disposal sites through the Project, the Project Purpose was more or less achieved. However, at the time of ex-post evaluation, waste collection services in the city are unstable due to shortages of waste collection vehicles, waste containers, etc., and no significant improvement in sanitary environment is seen in the City. Following completion of the Project, composting as well as construction of the new final disposal site have been suspended and not much improvement has been made in the operation of final disposal sites. Therefore, the Overall Goal has not been achieved. To sum up, the effectiveness and impact of the Project are deemed to be fair. The inputs of human resources and equipment were appropriate in terms of content and quality, however, because it took a long time for the Cuban side to prepare the compost yard and JICA to procure the equipment, the Project period was longer than planned. In addition, the project cost exceeded the planned budget due to increase of equipment cost. Therefore, the efficiency of the Project is fair. Concerning sustainability, while there are no problems regarding the policy and institutional aspects, there are some technical and financial issues. Since examination of a proposal to nationalize the solid waste management utility and preparations to establish a joint venture are still in progress, the Project is faced with major institutional and financial uncertainties in the medium to long term. Therefore, the sustainability of the Project is deemed to be fair.

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

¹ In administrative terms, Havana City is a Province composed of numerous Municipalities, however, in this report, it is referred to as “Havana City” according to the official title of the Project.

1. Project Description



Project Location



Night collection in the city by a waste collection vehicle

1.1 Background

Cuba's "National Environmental Strategy 2007-2010" earmarked solid waste management as an important area, and concerning solid waste management in cities, it specified clear numerical goals and activities for solid waste collection, recycling, final disposal site operation, separate collections, etc. for the objective of mitigating, preventing and controlling pollution caused by improper management. In Havana City (population in 2009: 2.14 million), DPSC and Municipal Direction of Communal Services (*Dirección Municipal de Servicios Comunes*; hereinafter referred to as "DMSC") of the 15 administrative municipalities that comprise the city were collecting solid waste and transporting them to outlying final disposal sites for disposal². However, following collapse of the Soviet Union at the beginning of the 1990s, Cuba's economy fell into recession and fuel shortage made it difficult to transport solid waste to final disposal sites

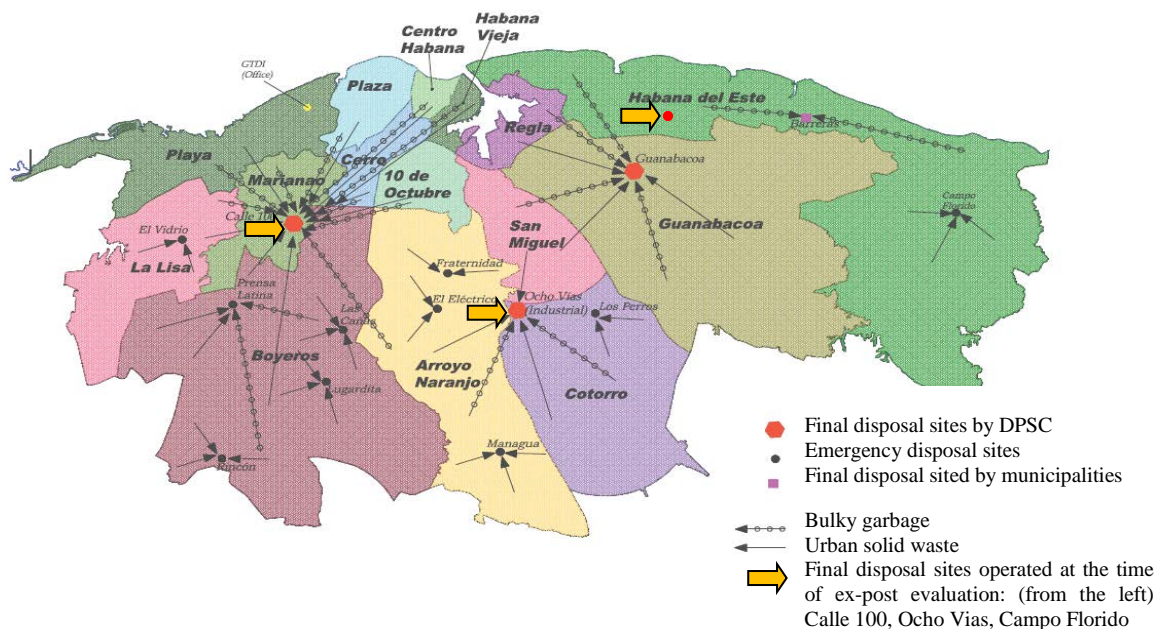
² Solid waste management in Havana City is carried out by DPSC and DMSC of 15 administrative municipalities. Provincial Unit of Hygiene (hereinafter referred to as "UPPH"), which is one of the departments of DPSC, has a vehicle maintenance workshop located next to the main final disposal site of "Calle 100". UPPH is allocated with waste collection vehicles as well as arm roll vehicles which are used for collecting construction wastes, etc. As of December, 2017, roughly 25 waste collection vehicles operating based on UPPH conduct waste collection in nine municipalities, while the remaining 12 waste collection vehicles collect waste in six outlying municipalities and receive inspections and repairs in the vehicle maintenance workshop of UPPH as necessary. Roughly half of the solid waste in Havana City is collected by the waste collection vehicles from approximately 20,000 containers that are placed on the city streets. The waste collection vehicles basically conduct patrols so that each container is collected once a day, and the collection work is performed day and night. In outlying areas of the city, trucks, tractors and horse-drawn carts belonging to DMSCs collect waste from individual households. The arm roll vehicles collect waste (general and construction wastes) from dedicated containers that are placed on streets. Several tens of dedicated containers are permanently placed around the city, and containers are also placed at building sites, etc. upon request. UPPH has around 10 waste removal teams each composed of one skid roller and 2-3 trucks, and they remove general and construction wastes discarded on streets and fallen trees and the like in the aftermath of hurricanes as necessary.

DMSC use trucks, etc. to collect general waste in the areas that are not patrolled by waste collection vehicles, and also to clean up the waste that is left behind around containers. Park and street cleansing personnel are assigned to several zone offices located around each municipality. These offices constantly grasp the situations of local waste collection and cleansing conditions, and make requests to DPSC and DMSC if additional waste collections or dispatch of waste removal teams are required.

As of December, 2017, three final disposal sites are operating in Havana City (see Figure 1). The biggest of these is Calle 100 final disposal site situated in the mid-west of the city, and this receives approximately 70% of the city's solid waste. The next biggest is Ocho Vias final disposal site in the east of the city, which receives approximately 25%. Also, in the east of the city is Campo Florido final disposal site, which is small and was originally intended to function as an emergency final disposal site.

in the suburbs. Accordingly, the solid waste was dumped in a number of emergency disposal sites temporarily installed in the city, leading to a deterioration in the living environment for residents. In addition, with major final disposal sites approaching full capacity, the securing of new final disposal sites became an urgent issue.

Against such a background, the Government of Japan implemented a JICA technical cooperation entitled: “The Study on Integrated Management Plan of Urban Solid Waste in Havana City (2004-2006)” (hereinafter referred to as “the prior technical cooperation”) based on a request from the Government of Cuba, and a Master Plan having 2015 as the target year was developed for drastic improvement of the solid waste management utility in Havana City. Based on the Master Plan, the Government of Cuba and Havana City authorities carried out such measures as the closure of most of the emergency disposal sites, improvement of existing final disposal sites, procurement of 70 waste collection vehicles and containers, adoption of a decision to construct the new Guanabacoa final disposal site in the east of the city and so on. In addition, in August, 2007, with a view to further improving the solid waste management utility in Havana City, the Government of Cuba requested the Government of Japan to implement a technical cooperation project entitled “Improvement of the Capacity on Urban Solid Waste Management in Havana City” (the Project). In response, the Government of Japan entrusted JICA to implement the detailed project formulation study in 2009, and the Project was commenced in September, 2009 over a scheduled period of three years and six months.



Source: Report of the “Study on Integrated Management Plan of Urban Solid Waste in Havana City”

Figure 1 Scope of Final Disposal Sites and Waste Collection in Havana City

(Positions of the three disposal sites in operation at the time of ex-post evaluation have been added to the figure from 2004)

1.2 Project Outline

The Project aims to strengthen the urban solid waste management capacity of Havana City through collaboration with relevant organizations by improving the waste collection and transportation capacity, the design and operation capacity of final disposal sites, capacity for reducing the quantity of organic waste for disposal of UPPH / DPSC, and the general solid waste management capacity of DPSC.

Overall Goal		Urban solid waste management is properly implemented in Havana City and sanitary environment of the City is improved.
Project Purpose		Capacity of DPSC on urban solid waste management in Havana City is strengthened through collaboration among cooperative organizations.
Outputs	Output 1	Comprehensive management capacity on solid waste of DPSC is improved.
	Output 2	Solid waste source separation at Pilot Project site is promoted and capacity of UPPH in organic waste reduction at the source is strengthened.
	Output 3	Capacity of UPPH in the collection and transportation of solid waste is strengthened.
	Output 4	Capacity of UPPH and DPSC on landfill design and operation of final disposal sites is strengthened.
Total cost (Japanese Side)		480 million yen
Period of Cooperation		September, 2009-February, 2013 Extension period: March, 2013-September, 2014
Implementing Agency		Provincial Direction of Communal Services (DPSC) and Provincial Unit of Hygiene (UPPH) under DPSC in Havana City
Other Relevant Agencies / Organizations		Ministry of Science, Technology and Environment, Havana Office (CITMA-Habana), DMSC of Playa Municipality, Water Resources Research Institute (IHR), Ministry of Agriculture (MINAGRI), Soil Research Institute (IS), Hygiene Research Institute of the Ministry of Health (MINSAP)
Supporting Agency / Organization in Japan		None
Related Projects		“Study on Integrated Management Plan of Urban Solid Waste in Havana City” (development study, 2004-2006), “Improvement of the Capacity on Waste Collection Vehicles Management in Havana City” (dispatch of experts, August 2015-April 2018), Dispatch of a short-term expert (2006)

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

Since the urban solid waste management capacity of DPSC in Havana City has been strengthened through collaboration among relevant organizations, it was deemed that the Project Purpose would be achieved by time of completion of the Project, provided that the Cuban side continues to make appropriate efforts.

1.3.2 Achievement Status of Overall Goal at the Terminal Evaluation (Including other impacts)

It was deemed that the Overall Goal would be achieved in 3-5 years, provided that the Cuban side makes the appropriate inputs. Moreover, the following impacts have been reported: improvement in outline design of the final disposal site in the west, implementation of maintenance for vehicles belonging to other provinces at the vehicle maintenance workshop, reflection of the Project activities in the environmental strategy of Havana City, sharing of national-level information on sanitary landfills.

1.3.3 Recommendations from the Terminal Evaluation

Recommendations applicable by the time of completion of the Project:

- With a view to securing the stable procurement of spare parts for the equipment provided; sort out the suppliers of spare parts; compile operation and maintenance methods for postponing the deterioration of equipment and averting failures into manuals; continue the systematic recording of failures; and establish an organizational unit to take charge of equipment maintenance.
- Finish the training for personnel of DPSC and DMSC as planned.

Medium- and long-term recommendations geared to after the Project completion:

- Update the manual developed in the Project as needed.
- Continue and complete construction of the new Guanabacoa final disposal site.
- Disseminate the knowledge and skills acquired through the Project to other provinces and municipalities.
- Disseminate the revised Master Plan geared to achievement of the Overall Goal to related officials and secure the budget for implementing priority projects.

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda (Global Group 21 Japan, Inc.)

2.2 Duration of the Evaluation Study

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

Duration of the Study: October, 2017-March, 2019

Duration of the Field Survey: November 22-December 21, 2017 and March 28-April 11, 2018

2.3 Constraints during the Evaluation Study

Nationalizing the solid waste management utility in Havana City and establishing a joint venture based on introduction of foreign capital are under examination which may affect sustainability of the Project in future. However, both plans are undecided and, due to the confidential nature of these matters, it was not possible to obtain sufficient information on them. Moreover, again due to issues of confidentiality, it was not possible to obtain sufficient information on the overall budget composition and financial trends of the implementing agencies. Therefore, it was difficult conducting detailed analysis on the medium- to long-term sustainability of the Project.

3. Results of the Evaluation (Overall Rating: C³)

3.1 Relevance (Rating: ③⁴)

3.1.1 Consistency with the Development Plan of Cuba

As already described in 1.1 Background of the Project, at the time of planning (2009), environmental preservation and conservation of resources were regarded as priority issues, and solid waste management in Havana City was being advanced according to the Master Plan that had been compiled in 2006 with technical cooperation from JICA.

In *the National Environmental Strategy* (2011-2015) at the time of Project completion (September, 2014), the deterioration of environmental sanitation due to shortages of solid waste collection vehicles and final disposal sites in the major cities was identified as one of the main issues in the environmental field. To remedy the situation, the Strategy pointed to the need for the following measures: appropriate allocation of resources and improvement of organizations and systems in the solid waste management field; drastic improvement in the solid waste management operations of DPSC and DMSCs, and an organized approach to cope with lack of social discipline and compliance with laws and regulations on garbage.

As such, relevancy of the Project to the development plans of the Government of Cuba was high at the time of planning and the time of project completion.

3.1.2 Consistency with the Development Needs of Cuba

According to the Detailed Planning Survey for the Project, issues at the time of planning were

³ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁴ ③: High, ②: Fair, ①: Low

as follows: 1) lack of activities for reducing the quantity of general solid waste that largely comprises kitchen garbage, 2) inadequacy of collection and transportation plans, 3) insufficient capacity of vehicle maintenance workshops and repair workshops, 4) technical deficiencies regarding design and operation and maintenance of final disposal sites, 5) insufficient basic capacity regarding planning and management in the planning sections of DPSC and UPPH.

At the time of project completion, there were 48 operational waste collection vehicles in Havana City (December, 2014), equivalent to roughly half of the needed number (92). Moreover, construction of the new Guanabacoa disposal site was suspended, and operation of the four final disposal sites that were operating at the time was not sufficiently improved except for one of the sites. In addition, the reduction in waste achieved as a result of composting in the Project was negligible compared to the overall amount of the waste, so there was a pressing need to further reduce the amount of waste. Therefore, at the time of project completion, there was still a very great need to improve solid waste management in Havana City.

To sum up, consistency of the Project with the development needs of Cuba was high at both the time of planning and the time of project completion.

3.1.3 Consistency with Japan's ODA Policy

At the time of planning, the Government of Japan was actively implementing economic cooperation for Cuba with a view to enabling it to effectively tackle its pressing development issues while striking a balance with social equity. In 2000, JICA dispatched its first Project Confirmation Study Team to discuss policies with the Government of Cuba, and the two sides reached a consensus about conducting cooperation with emphasis on the agricultural and environmental fields. Since then, the two governments have reaffirmed the policy of advancing cooperation centered in these two fields in periodic policy discussions.

Meanwhile, the Government of Japan was steadfastly adhering to actively promoting the 3R Initiative (for reducing, reusing, and recycling solid waste) that had been adopted following a proposal by then Prime Minister Koizumi at the G8 Summit of June, 2004. As well, in the Project, since know-how founded on 3R activities, which had been bolstered by Japan after 2000, came to be utilized, the Project was regarded as an effort geared to the international advancement of the recycling-oriented society.

Accordingly, it is deemed that the Project was consistent with Japan's ODA policies at the time of planning.

Based on the above, this project was highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Effectiveness and Impacts⁵(Rating: ②)

3.2.1 Effectiveness

3.2.1.1 Achievement of Outputs and the Process⁶

(1) Strengthening of capacity of DPSC and DMSC (Output 1)

The capacity of counterparts (officials of DPSC and UPPH) in their respective areas of work was strengthened through the Third Country Training in Mexico, domestic training and practical training conducted by the Experts. Although the counterparts were frequently switched during the period of cooperation, it was confirmed at the time of Project completion that capacity of 17 counterparts had been strengthened. However, the degree of strengthening among counterparts that joined midway during the Project was limited. Based on the solid waste management manuals that were developed by the Project, training was conducted for 550 employees of DPSC in Havana City and DMSCs in the municipalities. Also, the Master Plan that had been compiled in 2007 with technical cooperation from JICA was revised together with the counterparts in light of the current conditions. In addition, extracurricular activities for solid waste management education targeting eight elementary and junior high schools in the pilot municipality (Playa) were implemented. Public information activities including production of a TV spot, radio broadcasts, preparation of stickers targeting the general public were conducted as well. In view of the fact that the established indicators were largely achieved, the level of achievement of Output 1 is deemed to be high.

(2) Pilot Project for Composting (Output 2)

A pilot project entailing separate collection of organic waste and manufacture of compost (organic fertilizer) was implemented targeting five large-scale dischargers including hotels, agricultural markets and a tobacco factory. In the prior technical cooperation, survey of solid waste revealed that more than half of the solid waste discharged in Havana City is composed of kitchen wastes, so a “community compost” pilot project targeting general population was implemented with the objectives of reducing the quantity of waste, reducing transportation costs, and extending the useful life of final disposal sites. However, because they failed to conduct thorough separation of wastes, a new pilot project narrowing the targets to large-scale dischargers was implemented in the Project. Small-size trucks for collecting organic wastes were provided and the collected organic waste was carried to a compost yard on the site of UPPH to manufacture compost. Quantity of organic waste collected was unstable because the small-size trucks were used for collecting general waste during the busy tourism season, etc. when priority is given to general waste collections. However, the separation work generally proceeded well, and the planned quantity of compost was more or less manufactured by the end of the Project. Considering the degree of achievement of the indicators, the degree of achievement for Output 2 is deemed to

⁵ Sub-rating for Effectiveness is to be put with consideration of Impact.

⁶ The degree of achievement of each output at the time of project completion is attached at the end of the report.

be rather high. It should be noted that, while the manufactured compost had high quality and was utilized for maintaining green tracts owned by DPSC, permission to sell the compost could not be obtained by the end of the Project, and there is still no prospect of this happening⁷.



Waste collection vehicle undergoing inspection



Parts processing using provided equipment



Arm roll truck



Arm roll truck containers placed on a road

(3) Strengthening of capacity of UPPH for collection and transportation of solid waste (Output 3)

UPPH operates a vehicle maintenance workshop on the grounds of its office located adjacent to the largest final disposal site of Calle 100. Here, it conducts inspections and maintenance of the city's waste collection vehicles and arm roll vehicles. An important issue was to strengthen the capacity of the vehicle maintenance workshop with a view to improve the operating rate of waste collection vehicles of limited quantity. In the Project, maintenance and inspection equipment, parts processing equipment, etc. were provided to the maintenance workshop; vehicle maintenance and inspection standards were established; vehicle maintenance and inspection

⁷ DPSC is an administrative organization that does not possess an autonomous source of funding, so recycled materials and composts sales are not included in its jurisdiction. In the Master Plan of 2007, under "strengthening of legal systems", it was recommended that DPSC be allowed to sell recycled resources and compost on the market based on approval from the central government. The Project embarked on procedures to change the system to allow sale of compost six months following the start of separate collections in the Pilot Project. However, it still hadn't acquired permission by the time the Project was completed.

manuals were developed; and training was implemented for mechanics and other personnel. As a result, such results had been attained as shortened maintenance time, enhanced quality of maintenance, shortened waiting time for spare parts due to increased numbers of produced parts, and improved operating rates of waste collection vehicles. Considering that the degree of achievement of the indicators was also high, the degree of achievement for Output 3 is deemed to be high.

Furthermore, there is a strong possibility that this output contributed to lengthening of the service life of waste collection vehicles. To verify this, it is necessary to conduct analysis linking the operating time of each vehicle to the degree of deterioration, however, no such data was acquired in this evaluation. To realize the appropriate operation and maintenance of waste collection vehicles, it is also important to strengthen the capacity of drivers so that they can thoroughly implement inspections before the start of work, replace tires when out of the workshop, and acquire the skill to drive on poor quality roads. However, this was not included within the scope of the Project.

(4) Strengthening of capacity for design and operation of final disposal sites (Output 4)

DPSC was independently conducting basic design of an environmentally friendly final disposal site as proposed in the Master Plan concerning new Guanabacoa disposal site planned in the east of Havana City. However, as Cuba had no prior experience of such final disposal sites, there was room for improvement regarding design of the leachate treatment facilities and other aspects. Following advice provided by the Japanese experts dispatched by the Project, improvements were made to the design of the said disposal site on 12 points, more than the originally planned 11. However, due to the busy schedule of construction firms, lack of budget in the government and other factors, work on constructing the main body of the new Guanabacoa disposal site could not be commenced during the project implementation.

At the four existing final disposal sites, various issues were observed regarding management of incoming waste collection vehicles and loading of waste, management of dumping sites, management of waste pickers (people scavenging for valuable wastes), and frequency and methods of compaction and soil covering. The Japanese experts reviewed conditions of such works and landfilling sites together with the counterparts and gave advices on the methods of landfill work operations and management. They also provided a manual for landfilling. In addition, equipment for maintenance inspection and parts processing were provided to the maintenance workshop that works on the heavy machinery used on final disposal sites. In response to the given advice, UPPH made improvements to access roads, weighbridges, resulting in improved operations at all four final disposal sites. However, due to the frequent reshuffling of personnel, frequent breakdowns in heavy machinery, fuel shortages, lack of soil for covering and so forth, the level of improvement was limited. Accordingly, at the time of Project completion, only Calle

100 final disposal site had reached a standard that could be described as environmentally friendly final disposal site.

To sum up, the degree of achievement for Output 4 is deemed to be fair.

Table 1 Achievement of Project Purpose

Project Purpose	Capacity of DPSC on solid waste management is strengthened through collaboration among cooperative organizations ⁸ <Largely achieved>
Indicator	Actual
① The training program is formulated and begins to be implemented for DPSC / UPPH's members based on the experience with the trained Core Group	Training programs were prepared and the training was implemented for the core group (out of employees of DPSC, UPPH and DMSC, the heads of municipalities, zone officers, technicians, etc. were targeted; 520 persons in total). Training of other employees was not completed by the project completion in September 2014, but completed by the end of 2014. <Partially achieved>
② Capacity for collaborating with related agencies to conduct solid waste management is improved through the activities. (Additional indicator at the time of the terminal evaluation).	Through the Project, collaboration was commenced with the Ministry of Science, Technology and Environment concerning technical and environmental education, and also with the schools, enterprises, etc. that were involved in the Project. <Achieved>
③ Organic waste reduction achieved in the Pilot Project (to be about 1.5 t/day) to be maintained.	While the collected quantity of organic solid waste only just failed to reach the target (1.432 t/day between February and June, 2014), valuable experience and know-how were gained and cooperation with hotels, agricultural markets, a tobacco factory was established through the Pilot Project. Composting technology was appropriately transferred, and the manufactured compost is utilized in the preservation of the city's parks and green areas. <Almost achieved>
④ Vehicle repair and maintenance system upgraded by trained mechanics using equipment donated by the project to be maintained.	Compared to the target of reducing major repair and maintenance work times among vehicle maintenance workshop mechanics, times were reduced by between 39-77% depending on the work item concerned. <Achieved>
⑤ Improvement of collection and transportation by means of the upgraded average operating of collection vehicles and frequency optimization to be maintained	Compared to the target of increasing the fuel consumption of vehicles from 0.80 m ³ /L in 2008-2009 to 0.90 m ³ /L, the value was improved to 0.86 m ³ /L. <Partially achieved>
⑥ Environmentally friendly landfill design advised by the experts are incorporated in the new Guanabacoa disposal site.	12 items of environmentally friendly technology were adopted. <Achieved>

Source: Materials provided by JICA and DPSC

⁸ Cooperating agencies include Ministry of Science, Technology and Environment, Havana Office (CITMA-Habana), Playa DMSC (DMSC Playa), Water Resources Research Institute (IHR), Ministry of Agriculture (MINAGRI), Soil Research Institute (IS), and Hygiene Research Institute of Ministry of Health (MINSAP).

3.2.1.2 Achievement of Project Purpose

Concerning the Project Purpose of “capacity of DPSC on solid waste management is strengthened through collaboration among cooperative organizations”, six indicators were set as shown in Table 1 (one of these was added at the time of the terminal evaluation). Four of the indicators were achieved - almost achieved, while the remaining two were partially achieved. Considering that the degree of achievement of the outputs was also generally high (Output 1: high, Output 2: slightly high, Output 3: high, Output 4: fair), the project largely achieved its purpose.

3.2.2 Impacts

3.2.2.1 Achievement of Overall Goal

The Overall Goal of the Project is, “urban solid waste management is properly implemented in Havana City and sanitary environment of the City is improved”. Since achievement of this is predicated on the maintenance of the results achieved in the Project, the degree of achievement of the Overall Goal is analyzed upon reviewing the situation regarding continuation of activities under each output from project completion to the time of ex-post evaluation.

(1) Continuation of activities following completion of the Project

① Strengthening of solid waste management capacity, revised Master Plan, solid waste management education (Output 1)

Training based on the solid waste management manuals prepared in the Project continues to be provided for the employees of DPSC and DMSC. Some of the manuals have been introduced around the country through the Ministry of Economic Planning. The Master Plan that underwent revision in the Project is utilized for compiling environmental strategy in Havana City and preparing plans of DPSC based on that. However, due to the diversion of budget funds to measures for reconstruction following the hurricane disaster of 2017, budget constraints for Havana City’s environmental strategy investment program have become more acute and implementation has been further delayed. Concerning solid waste management education, the Project activities were continued for one year under the initiative of DPSC following completion of the Project. At the time of ex-post evaluation, teachers in charge at some of the schools involved in the Project were individually continuing the activities.

② Composting based on organic waste separate collection (Output 2)

Following the end of the Project, the director of UPPH was replaced, and the organic solid waste separate collection from hotels, agricultural markets, etc. and composting activities that had been commenced in the Project lapsed. The main counterpart who had worked on these activities (1 person) left the job. According to UPPH, the main reasons for the lapse of activities were as follows: 1) large human and mechanical burden entailed in conducting separate collection and

composting; 2) failure to secure permission to sell products; and 3) diversion of dedicated collection vehicles to general waste collection work due to the shortage of general waste collection vehicles. The compost yard that was constructed in the Project is now used as a site for keeping materials⁹.



Wastes scattered on the street



Construction wastes illegally disposed on the street



Waste cleaning outside of containers by DMSC



Skid roller used by a waste removal team

③ Strengthening of maintenance capacity for waste collection vehicles (Output 3)

Although there has been reshuffling of counterparts and mechanics, the UPPH vehicle maintenance workshop is generally operating appropriately except for some items of equipment. The indicators on operating times and repair times of waste collection vehicles are being maintained within the target scope. One year following completion of the Project, JICA commenced the technical cooperation project entitled “Improvement of the Capacity on Waste Collection Vehicle Management in Havana City” (hereafter referred to as the “follow-up technical

⁹ At the time of ex-post evaluation, DPSC is examining plans to restart the separate collection of organic waste and production of compost and biogas based on the experience of the Project, etc. On the premise of UPPH, in addition to the composting by the Project, a biogas plant (using organic waste) constructed through cooperation of the United Nations Industrial Development Organization was operating. However, its operation has been suspended since 2014. In the case where production of compost and biogas is restarted, it is scheduled for compost to be used in the upkeep of UPPH green areas and biogas to be used for generating power for internal use.

cooperation”) with the goal of realizing high-level maintenance centered on preventive maintenance. In this project, establishment of preventive maintenance and inspection standards for vehicle accessories, improvement of maintenance techniques, preparation of maintenance manuals for new waste collection vehicle models (made in China), development of digitized ledgers were carried out. As a result, it is thought that capacity of the vehicle maintenance workshop has been strengthened even more after the end of the Project.

Meanwhile, the deterioration of waste collection vehicles had been accelerated by various factors including the following: 1) frequent tire punctures were caused by the poor quality of roads inside final disposal sites; 2) following the start of nighttime collections in 2012, due to the shortage of waste collection vehicles, the daily operating time of vehicles reached as high as 18 hours per day on an average; and 3) mixing of rubble and other heavy items into household waste placed a heavy load on hydraulic systems. Furthermore, the number of operating vehicles declined by the fact that it took a long time to import parts for certain vehicle models. While DPSC introduced 48 Chinese-made collection vehicles over four years between 2014-2017, due to the factors described above, the number of operable waste collection vehicles is around 40 (out of a fleet of 90 vehicles), even lower than the figure of around 50 at the time of Project completion. According to DPSC, this is less than half the required number of vehicles, meaning that it cannot provide stable waste collection services. Meanwhile, if more waste collection vehicles can be introduced through Japan’s non-project grant aid, it anticipates that it can break the negative cycle of: shortage of vehicles → excessive operation → acceleration of deterioration → further decline in number of vehicles¹⁰.

According to a series of interviews with DMSCs, heads of administrative zones and residents¹¹, waste collections are basically conducted once per day in Havana City, however, this can drop to once every two or three days when there are vehicle shortages. Moreover, many voices

¹⁰ According to DPSC, it is estimated that 92 large-size waste collection vehicles (16 tons) are required to conduct waste collection in Havana City. It is scheduled for approximately 70 medium-size collection vehicles (12 tons) to be procured under Japan’s non-project grant aid by the end of 2019. Also, it is scheduled for arm roll vehicles, skip loaders and trucks (numbers to be decided) to be procured under Japan’s non-project grant aid in 2020. It should be noted that, since the number of operable waste collection vehicles is affected by the number of vehicles that are renewed every year, this cannot be used as an indicator to directly reflect the improvement in the capacity of maintenance workshops as a result of the Project.

¹¹ In this ex-post evaluation, the following survey was implemented with the aim of analyzing the factors of effectiveness and impacts.

- Targeting five major municipalities out of those where UPPH conducts collection services using waste collection vehicles, interviews were conducted with each DMSC (including municipal solid waste management corporation in two of the municipalities), one or two municipal officers (9 persons in total; significant extraction on the streets of visited districts), and one or two residents (9 persons in total), and the conditions of local waste collection were inspected in each municipality.
- Individual interviews were held with residents living around two final disposal sites (4 persons in total).
- Interviews were held with one hotel and one agricultural market that participated in the Pilot Project for separate collection and composting.
- Interviews were held with teachers in charge at the elementary and junior high schools that participated in the Project’s environmental education (2 teachers at 2 schools), and conditions were inspected at one school.
- Hearings were conducted with Havana provincial government, the Ministry of Science, Technology and Environment, and Havana City Health Department.

said that the waste collection services conducted by collection vehicles have deteriorated in recent years. Moreover, it was pointed out that operation of the same waste collection vehicles by multiple drivers working on different shifts may impair awareness of the need for appropriate operation and maintenance inspections and lead to further decline in operating rates.

④ Strengthening of capacity for design and operation of final disposal sites (Output 4)

Following completion of the Project, the decision was made to construct the new Guanabacoa final disposal site under a new joint venture with foreign capital, and the project for new Guanabacoa final disposal site was transferred to the Ministry of Industry. At the time of ex-post evaluation, the new joint venture has not been established and the construction has been suspended. It is scheduled for the past plans and design to be fundamentally revised.

Concerning existing final disposal sites, a new access road and administration office were built and the weigh bridge (truck scale) functions were restored at Calle 100 disposal site, which was conducting the most appropriate landfill disposal at the time of Project completion. Although the responsible counterparts and personnel in charge were subsequently replaced, the know-how and experience obtained through the Project have been sustained to a certain extent through the manuals and final report that were prepared in the Project.

According to observation of Calle 100 disposal site and hearings with responsible personnel at UPPH, waste compaction is conducted to a certain extent, while it is not enough. The minimum required soil covering is conducted. However, due to the shortage of soil, construction wastes (rubble) are frequently used instead¹². As a result, organic wastes heat up due to biodegradation caused by coming into contact with air, leading to constant emission of smoke and even occurrence of fires during the dry season. Furthermore, collection vehicles experience frequent punctures as a result of driving over waste that hasn't been sufficiently compacted and covered with soil.

Because of the difficulty in dumping waste at night due to absence of lights and during rainfall due to the muddy roads, trucks were observed dumping waste beside access roads and at the final disposal site entrances at the time of the first site survey (November, 2017, rainy season). However, by the time of the second site survey (April, 2018, dry season), a system for confirming appropriate disposal based on issuing cards to drivers who dump in the proper place had been adopted at the disposal site exit. While collection of valuable wastes on this disposal site by UPPH was stopped, numerous waste pickers still unofficially scavenge for valuable items¹³. Such

¹² According to DPSC, it has been decided to use residual soil from a mine on the outskirts of Havana City for use in soil covering at Calle 100 disposal site, however, as of April 2018, the method of transporting soil is still under examination.

¹³ An enterprise for recovery of raw materials purchases all collected valuable resources. This enterprise, which is under the jurisdiction of the Ministry of Industry, purchases recyclable plastics, paper, metal and so on from factories, businesses, recyclable resource exchange houses in each municipality, DPSC, UPPH, etc. in Havana City and sells them to industry. The enterprise does not collect organic wastes. According to explanation given by UPPH, since the

activities are violations of the law, and the proactive management of registrations and training is not implemented.

Summing up the general situation, the operation and maintenance of existing final disposal sites is deemed to be largely unchanged since the time of Project completion.

(2) Achievement of Overall Goal

The Overall Goal of the Project is “urban solid waste management in Havana City and sanitary environment of the City is improved”. As is shown in Table 2, none of the four indicators that were set concerning the Overall Goal have been achieved at the time of ex-post evaluation.

Table 2 Achievement of Overall Goal

Overall Goal	Urban solid waste management in Havana City and sanitary environment of the City is improved. <Not achieved>
Indicator	Actual
① Two or more entities in Havana City consider introducing the waste reduction model practiced in the Pilot Project.	The Pilot Project activities were suspended six months after the end of the Project. At the time of ex-post evaluation, DPSC and UPPH are examining the resumption of compost manufacture. <Not achieved>
② Volume of solid waste for recycle recovered by DPSC and UPPH from waste in Havana City reaches 6,400 t/year from the current level of 4,000 t/year.	At the time of ex-post evaluation, DPSC and UPPH do not collect recyclable resources or organic wastes, and there is no contribution from the Project. <Not achieved>
③ The level of satisfaction among Havana's citizens in terms of the integrated solid waste management increases.	Reduction in the number of complaints from residents, which was regarded as the representative indicator (from 60 complaints per municipality per year to 36 complaints per municipality per year) had already been achieved at the time of Project completion. However, judging from the interviews with the DMSC and residents (see the main text), it cannot be said that the level of satisfaction that citizens of Havana City hold towards solid waste management has improved. <Not achieved>
④ Number of environmentally friendly final disposal landfill sites which are properly maintained is two or more at the end of the Project while there was only one at the beginning of the Project.	Generally speaking, the maintenance situation of the three final disposal sites in operation at the time of ex-post evaluation has not changed much compared to the time of Project completion. The new Guanabacoa disposal site still hasn't been constructed. Therefore, at the time of ex-post evaluation, only Calle 100 disposal site is properly maintained. <Not achieved>

adoption of purchase prices which are more advantageous to individual pickers than UPPH, it has become harder for UPPH to collect recyclable materials on final disposal sites.



Calle 100 disposal site soil covering (left); waste pickers operating in the waste dumping zone (right)

Composting by UPPH was suspended six months after the end of the Project (Indicator ①). At the time of ex-post evaluation, the idea of restarting composting in tandem with the biogas production by another project is being examined, while there are no concrete prospects as yet (see footnote 9). Concerning recovery of solid wastes on final disposal sites (Indicator ②), collection of valuable waste materials (recyclable resources) by UPPH has been suspended, while collection by unofficial waste pickers is continuing. On the other hand, collection of recyclable wastes (cardboard, bottles, metal, etc.) by the Enterprises for Recovery of Raw Materials increased from 16,000 tons in 2005 to approximately 53,000 tons in 2017 due to the fact that collections were extended from public enterprises to private sector enterprises and individuals¹⁴. Even so, recycled resources still account for less than 1% of the total amount of solid waste collected by DPSC (approximately 6,800,000 tons in 2016)¹⁵. Therefore, waste reduction through recycling and compost manufacture activities is negligible, and the contribution made by the Project is no longer around.

In the districts where waste collection vehicles provide services, imported plastic waste containers have been installed. Locally made containers were partially introduced from 2015 on trial bases. UPPH is trying to solve some design issues (the covers were too heavy, and the containers were prone to falling over), but it is not yet fully successful due to constraints in manufacturing technology. Many containers are rendered useless and few are in good condition due to breakage, theft and so on. While UPPH plans to renew roughly 50% of all containers every year¹⁶, according to the DMSC, the shortfall in the number of containers is large. Moreover, because containers are not cleaned, waste tends to stick and attracts flies, etc.

As was mentioned previously, the number of operable waste collection vehicles has declined

¹⁴ In recent years, the number of recyclable resource exchange houses in the city has increased, and purchasing of valuable waste materials from the general public has become more common. The organic waste collection and compost manufacturing activities targeted by the Project are not included in this enterprise's work.

¹⁵ In the M/P, it was planned to recycle approximately 17% of solid waste by 2015 with a view to reducing the quantity of waste.

¹⁶ In 2018, it is planned to procure approximately 12,000 containers (7,000 made in Cuba and 5,000 imported).

following the end of the Project. Only half of the required number of vehicles are operable, resulting in destabilization of waste collection services. Combined with the large shortfall of containers, the containers are filled to overflowing before collections and the areas around containers become littered with the wastes that cannot fit in. Such cases were numerous observed around the city. Furthermore, due to the sharp increase in house building and reforms under the subsidy system that was introduced in 2015, the quantity of construction wastes increased a lot and has led to more waste being discarded on streets. The lack of discipline among residents concerning waste discharge further exasperates the problems. In contrast, such problems are relatively uncommon in districts that contain government offices, embassies and tourist districts that have been prioritized for the allocation of containers and waste collection vehicles. Personnel of DMSC daily grasp waste collection conditions within the municipalities. However, it has been difficult to analyze the appropriateness of waste collections and quantitative changes over time due to the absence of indicators for directly reflecting these situations¹⁷.

According to interviews with responsible personnel in DMSC and municipalities, there have been no noticeable improvements in the services by waste collection vehicles in recent years. They report that vehicles frequently cannot be assigned on schedule due to punctures and various other reasons, while many people even said that the level of services had worsened recently. In interviews with residents, almost half of the respondents said that waste collection services had deteriorated over the past five years, while the other half said services had remained the same. Considering that the various problems described above regarding waste collection, it cannot be said that the level of satisfaction that citizens of Havana City hold towards solid waste management services has improved (Indicator ③). Moreover, as was described above, no major changes have been observed in the operation of final disposal sites following completion of the Project (Indicator ④).

To sum up, it is deemed that the Overall Goal of the Project has not been achieved.

3.2.2.2 Other Positive and Negative Impacts

(1) Social and environmental impacts

According to interviews with the DMSC and residents, no major impacts (improvement or deterioration) have been confirmed in terms of environmental sanitation in Havana City. According to the Provincial Direction of Public Health of Havana City incidences of diarrhea in the city declined in 2017, and there is no evidence that disposal of wastes on roads due to unstable collections is imparting negative impacts in terms of environmental sanitation or diseases.

According to residents who live around the final disposal sites, there have been no improvements in the environment around sites. There were reports of more smoke affecting daily

¹⁷ DMSC reports to DPSC about its street cleaning and waste collection activities, quantities of waste collection containers according to their condition, the number of containers still needed, and so on.

life and numbers of rats increasing around some final disposal sites, however, nothing concrete was ascertained. The Project did not entail any relocation of residents or land acquisition.

(2) Other impacts

UPPH vehicle maintenance workshop sometimes unofficially gives advices upon request from other municipalities on maintenance and repairs on special types of waste collection vehicles. It sometimes shares information based on the maintenance manuals that were prepared in the Project. Meanwhile, sanitary landfill concepts and training contents have been introduced to officials of other provinces via national training, while no concrete extension activities have been conducted.

The outputs and experience acquired from JICA's technical cooperation activities including the Project have been referred to in formulating the Havana City environmental strategy, nationalization of the city's solid waste management utility and establishment of a joint venture (described in detail in the section on Sustainability)¹⁸.

In summary, the degree of achievement of the Project Purpose is high. However, manifestation of the outputs and Project Purpose following the end of the Project has not been good and the Overall Goal has not been achieved. Accordingly, effectiveness and impact of the Project are fair.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

The following table shows the planned and actual inputs in the Project by the Japanese side and the Cuban side.

¹⁸ According to DPSC, the results of the first solid waste survey in Havana City conducted in the prior technical cooperation and the basic direction indicated in the Master Plan have been regarded as important sources of information up to the time of ex-post evaluation.

Table 3 Comparison of Planned and Actual Inputs in the Project

Inputs	Plan	Actual (time of Project completion)
Inputs on the Japanese side		
(1) Experts	Chief advisor / integrated solid waste management, composting / segregated collection of waste, machinery at maintenance workshop, final disposal landfill, vehicle maintenance	Chief advisor / integrated solid waste management, composting / segregated collection of waste, machinery at maintenance workshop, final disposal landfill, vehicle maintenance, coordinator (8 persons, 84 man-months)
(2) Trainees received	Training in Japan Third country training	Training in Japan: none Third country training: 10 persons
(3) Equipment	Organic waste collection vehicles, community compost yard construction materials, organic waste containers, collection vehicles repair equipment, landfill heavy machinery maintenance equipment	Ditto: Total Approximately 88 million yen
(4) Overseas project strengthening costs	(Planned amount unknown)	Approximately \$1,470,000
Japanese Side Total Project Cost	Total Approximately 350 million yen	Total 480 million yen
Inputs on the Cuban side		
(1) Assignment of counterparts	(Planned number of personnel unknown)	48 persons in total
(2) Facilities and equipment	Office, equipment and materials installation facilities, etc.	Office, vehicle maintenance workshop, compost yard
(3) Onsite costs		Donated equipment installation works costs, lighting and heating expenses, telephone and traffic expenses, etc.

Source: Prepared by the evaluator based on materials provided by JICA

3.3.1.1 Elements of Inputs

According to the counterparts, the experts were deemed to have high capacity and the quantity of expert man-months was appropriate. Also, the equipment was appropriate in terms of both type and quantity. Judging also from the contents and quality of the Project completion report, it can be gathered that the team of experts strived to conduct careful and attentive technology transfer. Due to the impact of the United States' policy regarding Cuba, machine tools that make use of the latest technology (processing equipment based on numerical control, etc.) were not introduced. However, according to the counterparts, the technical standard of the provided equipment was appropriate and consistent with actual conditions in Cuba.

According to the experts, although the assigned counterparts were appropriate in terms of

their numbers and quality, the results of the technology transfer were not fully accumulated due to subsequent frequent replacement of the counterparts without making adequate preparations for transferring duties. Moreover, the efficiency of activities was affected by the fact that much time was required in acquiring visas, preparing for appointments with relevant organizations and getting equipment through customs, and the fact that means of communication (email, telephone, etc.) with the counterparts when the experts were out of the country were limited. Also, since construction of the new Guanabacoa disposal site was greatly delayed due to the construction firm's busy schedule, non-execution of budget and inability to arrange for heavy machinery and other reasons, an opportunity for the experts to offer advice during execution of the construction works was lost.

3.3.1.2 Project Cost

The Project cost on the Japanese side was planned as 350 million yen but actually amounted to 480 million yen (131% compared to the planned value). Out of the increased cost, 70% arose because of the additional dispatch of experts made necessary by extension of the period of technical cooperation (described in the next section), and 30% arose from the increase in the amount of donated equipment.

3.3.1.3 Project Period

The Project period was planned to be 42 months from September 2009 to February 2013. The Project was commenced on schedule in September 2009, however, for the reasons given below, delays arose and the Project period was extended by 19 months to 61 months (145% compared to the planned value).

- Because it took a time for the Cuban side to secure a compost yard site, the time required for its preparation increased from the planned five months to 15 months.
- Equipment provided by the Japanese side for the vehicle maintenance workshop had to be procured in three installments due to constraints in the procurement procedure on the JICA side. Moreover, some equipment that was initially thought could be procured in Cuba proved to be unavailable and had to be procured from outside the country. As a result, procurement and installation of the workshop equipment took 19 months, three times longer than planned.

In summary, because both the project cost and project period exceeded the plan, the efficiency is fair.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and Political Commitment for the Sustainability of Project Effects

In the latest National Environmental Strategy (2016-2020: draft pending approval as of April 2018), urban solid waste management is earmarked as an important issue. The following strategies are proposed in connection with this: 1) control and prevention of pollution arising from inappropriate final disposal sites, 2) assuring resources to urban solid waste management, and 3) adoption of more efficient and modern technologies in investment projects in the urban solid waste management sector.

The latest Havana City Environmental Strategy (2016-2020) was compiled in accordance with the above National Environmental Strategy. The objectives are given as follows: 1) construction of a new organizational structure in solid waste management, 2) implementation of sanitary landfilling (appropriate compaction and soil covering) at final disposal sites, 3) reduction in the quantity of waste through recovery of valuable materials, and 4) securing of equipment for waste collection (waste collection vehicles, etc.), and annual plans for the achievement of these goals are indicated.

Based on the above, urban solid waste management is an important policy area in Havana City, and the Project sustainability is high in terms of policy and systems.

3.4.2 Institutional / Organizational Aspects for the Sustainability of Project Effects

Concerning the maintenance of collection vehicles, after completion of the Project, DPSC has newly signed contracts with multiple maintenance workshops under the jurisdiction of the Ministry of Industry so that it can outsource major repairs, engine retrofitting and other maintenance works geared to extending service life. This has made it possible for UPPH maintenance workshop to concentrate on regular inspections / maintenance works and minor repairs. In weekly meetings held with related agencies (representatives of DPSC, UPPH, and maintenance workshops under the jurisdiction of the Ministry of Industry), UPPH confirms maintenance conditions and discusses maintenance works. Moreover, UPPH has established a dedicated section in charge of vehicle maintenance according to the recommendation made in the terminal evaluation. On the other hand, organic waste separate collection and composting have been suspended and the responsible section has been disbanded.

UPPH is one unit of an administrative organization that receives a budget allocation from the government, and it does not possess an autonomous source of funding but rather depends entirely on the government budget. However, the Government of Cuba, which greatly depends on tourism revenue which is not stable, is faced with a difficult fiscal situation, and budget allocations to solid waste management in Havana City are subject to numerous constraints. Therefore, plans are being examined for nationalizing the solid waste management functions of UPPH and DMSC and strengthening finances through collecting sufficient tariffs from enterprises and businesses.

According to DPSC, a feasibility study for this was implemented in 2017, and options regarding the organizational structure and tariff system were proposed at this time. Since the target areas comprise the city and multiple administrative municipalities, the proposed contents are complicated and will require revision of legislation, so the examination work requires time.

On the other hand, due to the financial constraints, it has been difficult to secure sufficient funding for large-scale investments including construction of the new Guanabacoa disposal site. As a result, in 2014, the government decided on a policy to establish a foreign capital-based joint venture centered on the Enterprise for Recovery of Raw Materials under the jurisdiction of the Ministry of Industry, and it has advanced preparations for this. According to the explanation given by DPSC, it is projected that the new enterprise will construct and operate the new Guanabacoa disposal site, conduct recycling and biogas generation, and conduct separate collection, etc. in areas where ample profitability based on tariffs collected from enterprises and businesses can be anticipated. Numerous foreign corporations based mainly in Europe and America have expressed an interest in establishment of the joint venture, and the selection process for partners is in progress at the time of ex-post evaluation. The concrete business plan will be examined after the partner enterprises have been selected. Meanwhile, UPPH will continue to implement the operations that will not be transferred to the joint venture including collection and transportation in certain areas, operation and closure of existing final disposal sites, etc.

As was mentioned previously, the latest environmental strategy for Havana City mentions construction of a new organizational setup for solid waste management. In the Master Plan of 2007, as well, the necessity for this was raised from the viewpoint of securing financial sustainability. If the abovementioned changes can be realized, they could become an important step in improving the city's solid waste management utility and securing its financial sustainability. However, the success of such plans cannot be judged at the time of ex-post evaluation until the specific business plans of both sides are compiled.

To sum up, concerning the institutional/organizational sustainability of the Project, no short-term problems are expected regarding UPPH vehicle maintenance workshop and final disposal sites. However, overall there are major uncertain aspects in the fair to long term.

3.4.3 Technical Aspects for the Sustainability of Project Effects

As with other public servants in Cuba, employees of DPSC and UPPH have lower salaries than private sector or self-employed workers. As a result, only around 70% of approved management posts and technical posts are filled, and many workers move overseas or switch to the private sector. Out of the counterparts who were employed at the time of Project completion, only around 30% are still in employment at the time of ex-post evaluation.

Concerning the strengthening of solid waste management capacity, the revised Master Plan, and solid waste management education, etc. (Output 1) and strengthening of maintenance capacity

for waste collection vehicles (Output 3), the main counterparts have remained in at their posts and technical continuity can be observed on the work. Moreover, the revised Master Plan, the Project Completion Report, and collection vehicle maintenance manuals bequeathed by the Project are referred to and fully utilized. Also, roughly half of the repair mechanics who received training at the maintenance workshop have continued to work there after completion of the Project¹⁹. It is thought that their technical capacity has been enhanced even further thanks to the training conducted in the JICA follow-up technical cooperation. Concerning operation of final disposal sites (Output 4), although the counterparts have left their posts, know-how and technical information have been passed on to successors to a certain extent via the manuals and the Project Completion Report. On the other hand, concerning composting based on the separate collection of organic waste (Output 2), although the manuals and completion report remain, the section in charge has been disbanded and the counterparts are no longer involved.

To sum up, there are partial issues regarding the Project sustainability in the technical aspect.

3.4.4 Financial Aspects for the Sustainability of Project Effects

Execution of the investment program for the Havana City environmental strategy has been delayed due to the harsh fiscal situation facing the Government of Cuba and constraints arising from the fact that funds have been diverted to the recovery effort in the aftermath of the hurricane disaster of 2017.²⁰

At UPPH vehicle maintenance workshop, the budget for imported spare parts was reduced over the three years between 2014-2016. The budget for domestically procured parts and repairs outsourced to the Ministry of Industry is increasing gradually. However, according to UPPH, it is still not enough. Moreover, the limited number of suppliers and availability of spare parts and materials for fabricating parts is major constraints for the workshop.

Meanwhile, the annual budget required for renewing collection vehicles, other vehicles, and heavy machinery that exceeds the service life, renewing waste containers, and conducting operation and maintenance of disposal sites is secured to a certain extent, although it cannot be described as adequate. Since waste collection vehicles and arm roll vehicles will be donated under Japan's non-project grant aid, this will alleviate the budget constraints in the short term.

Information could not be obtained concerning the overall budget allocations and total expenditures of DPSC and UPPH. It should be also noted that, if the aforementioned organizational changes are executed, it is anticipated that the financial constraints placed on maintenance in the Project will be alleviated.

To sum up, there are some issues regarding the Project sustainability in the financial aspect.

¹⁹ Since repair mechanics are paid wages according to the amount of work they do, they have higher salaries than personnel in managerial and technical posts. This leads to a higher retention rate of personnel.

²⁰ Since the collapse of the Soviet Union in 1991, the financial situation of the Cuban Government continues to be severe as a result of the strong influence of US policy against Cuba.

Based on the above, although there are no issues regarding the Project sustainability in the policy and institutional aspects, there are some issues in technical and financial terms, and major uncertainty exists in the medium to long term regarding the organizational and financial aspects. Taking into account the fact that some activities have been discontinued following completion of the Project, the Project sustainability is deemed to be fair.

4. Conclusion, Recommendations and Lessons Learned

4.1 Conclusion

The Project was implemented with the Project Purpose “to strengthen capacity of DPSC on urban solid waste management in Havana City through collaboration among cooperative organizations.” and the Overall Goal “to properly implement urban solid waste management in Havana City and improve the city’s sanitary environment”. The importance of solid waste management within the policies and development needs of Cuba and Havana City was high at both the time of planning and the time of completion of the Project. The Project was relevant to Japan’s ODA policy at the time of planning. Based on the above, the relevance of the Project is high. As a result of the strengthening of collaboration among related agencies, strengthening of solid waste management capacity, the pilot project for composting, strengthening of vehicle maintenance workshop capacity, improvement in the design of a new final disposal site, and improvement in the operation of existing final disposal sites through the Project, the Project Purpose was more or less achieved. However, at the time of ex-post evaluation, waste collection services in the city are unstable due to shortages of waste collection vehicles, waste containers, etc., and no significant improvement in sanitary environment is seen in the City. Following completion of the Project, composting as well as construction of the new final disposal site have been suspended and not much improvement has been made in the operation of final disposal sites. Therefore, the Overall Goal has not been achieved. To sum up, the effectiveness and impact of the Project are deemed to be fair. The inputs of human resources and equipment were appropriate in terms of content and quality, however, because it took a long time for the Cuban side to prepare the compost yard and JICA to procure the equipment, the Project period was longer than planned. In addition, the project cost also exceeded the planned budget due to increase of equipment cost. Therefore, the efficiency of the Project is fair. Concerning sustainability, while there are no problems regarding the policy and institutional aspects, there are some technical and financial issues. Since examination of a proposal to nationalize the solid waste management utility and preparations to establish a joint venture are still in progress, the Project is faced with major institutional and financial uncertainties in the fair to long term. Therefore, the sustainability of the Project is deemed to be fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

(1) Improvement of waste collection services

Although a certain degree of improvement can be anticipated in the waste collection of Havana City with the new waste collection vehicles, etc. to be introduced through Japan's cooperation, there are still many issues to be solved and the streets are still littered with waste. DPSC will need to continue striving for improvement of waste collection services while making full use of the experience gained through the Project. It will be necessary to tackle the issues described below.

- **Monitoring of waste collection:** As an indicator which directly reflect waste collection performance in the city, it is proposed that new indicators be adopted regarding the quantity, types and number of container sites of wastes discarded outside of containers, and that monitoring be conducted according to each administrative zone and municipality. Doing so will clearly show the extent of improvement of waste collection services in quantitative terms and provide a specific basis regarding needs for resource allocation. Alternative indicators could be set based on the number of dispatches of waste removal teams, the quantity of waste collected by DMSC in those areas served by waste collection vehicles (the amount of waste separately collected by DMSC because it couldn't be collected by the waste collection vehicles)²¹.
- **Continued procurement and appropriate management of waste containers:** It is necessary for DPSC to accurately gauge the required number of waste containers and procure them every year in an ongoing effort. Also, it needs to examine a method for efficiently cleaning containers and disseminate information on sanitary waste disposal methods such as discharging raw waste in plastic bags to avoid direct dumping with a view to ensuring the sanitary use of containers.
- **Improvement of social discipline concerning waste:** It will be necessary to establish and disseminate guidelines about waste discharge and container handling methods for waste dischargers and improve the discipline of residents concerning solid waste management. It will be necessary for Havana City and DPSC to collaborate with related agencies and effectively implement activities while referring to the experience of the Project. For this purpose, it will be necessary to assign dedicated employees to DPSC. In view of the fact that a large number of waste collection vehicles will be newly introduced leading to a certain degree of improvement in waste collection services in 2018-2019²², one idea will

²¹ These services would not be required if services by waste collection vehicles and arm roll vehicles were properly provided, except in cases where fallen trees, etc. need to be cleared in the wake of hurricanes and so on.

²² It is difficult to improve social discipline without making any improvements to waste collection services. In this

be to implement a clean campaign to coincide with the 500th anniversary of Havana City in 2019.

- Appropriate operation and maintenance of waste collection vehicles: To ensure the appropriate and long-term operation of the newly introduced large number of waste collection vehicles, it will be necessary to limit the daily operating time of vehicles to an appropriate range and strive to secure ample time for inspections and maintenance²³. At the vehicle maintenance workshop, in addition to supplying sufficient consumables for maintenance equipment, it will be necessary to leverage the know-how gained in the Project and follow-up technical cooperation to ensure that the newly introduced vehicle models undergo proper maintenance, inspections and repairs.
- Assignment and training of waste collection vehicle drivers: It will be necessary to train drivers in methods for conducting routine inspections and maintenance, driving on poor quality roads without harming vehicles, appropriately repairing punctures on roads or at final disposal sites. Taking the upcoming increase in the number of vehicles as an opportunity, the number of drivers should also be adjusted so that each vehicle has one driver with a view to motivating drivers to have more awareness and a greater sense of responsibility.

(2) Appropriate operation of final disposal sites

Since it will still take at least a few more years before the new Guanabacoa disposal site can commence operation, extending the useful life of existing final disposal sites that are approaching their landfill limit is an important issue that requires urgent attention. Concerning Calle 100 disposal site, which will require ongoing investment for a considerable period, it will be important to leverage the information and experience acquired in the Project to assess the remaining landfill capacity²⁴, promptly examine a life extension plan and landfill plan, and conduct programmed operation and maintenance with an eye on upcoming site closure. Moreover, it will be necessary to efficiently maximize the remaining landfill capacity through securing heavy machinery and soil for covering, and conducting highly concentrated landfill by appropriately implementing compaction, soil covering and dumping site management while amply referring to the Project manuals and the Project Completion Report.

regard, the introduction of new waste collection vehicles is considered to provide a good opportunity.

²³ In the Master Plan, it was proposed that the operating time of each vehicle, which was 9 hours per day on average in 2006, should be reduced to 8 hours so that inspection and maintenance time can be secured.

²⁴ In the prior technical cooperation, simple GPS was used to measure elevation in a number of locations on landfill sites in 2013. For example, it should be possible to analyze the residual capacity of the same disposal sites based on changes in altitude at the same locations that were measured in 2013 and the amount of landfill that has been conducted up to 2018.

(3) Consolidation of solid waste management organizations

If nationalization and establishment of a joint venture in Havana City's solid waste management services are successful, this could lead to the medium to long-term sustainability of the Project. It is desirable for this to be realized upon fully examining their technical, financial and institutional feasibility. For this purpose, it will be necessary for the Cuban side to acquire the ability to fully understand comprehensive and appropriate solid waste management. It will also be important for it to learn international experiences regarding urban solid waste management.

4.2.2 Recommendations to JICA

It will be necessary for JICA to examine the necessity and feasibility of technical cooperation geared to supporting the Cuban side in implementing the above recommendations upon taking the following factors into account: 1) solid waste management in Havana City still faces numerous issues; 2) JICA has store of experiences accumulated through the prior technical cooperation, the Project, and the follow-up technical cooperation; 3) it is scheduled for new models of waste collection vehicles, arm roll vehicles, etc. to be donated through non-project grant aid.

4.3 Lessons Learned

Prior gauging of the degree of employee retention in implementing agencies and preparation of countermeasures

When developing a technical cooperation project, it will be necessary to assess in advance to what extent employees are retained in the implementing agencies. More specifically, possible measures for assessing the degree of retention will include; confirming the length of service of every employee in the implementing agencies, analyzing transfer destinations and reasons for switching jobs. In organizations where the degree of retention is not high, it is also necessary to grasp handover conditions when employees leave posts or switch jobs and check on the existence of organized initiatives for training successors. In addition, based on the above information, it is necessary to include in the scope of cooperation measures for improving employee retention and strengthening the capacity of the organization so that it isn't impacted by job separations and transfers of employees.

In the Project, the main implementing agencies were DPSC and UPPH, and, because numerous employees left their posts in search of higher salary without handing over their duties in a satisfactory manner, the frequent turnover of counterparts during the Project had a negative impact on the efficiency of the technology transfer. Furthermore, following completion of the Project, 70% of the counterparts who were employed at the time of Project completion have left their posts by the time of the ex-post evaluation, and this has greatly impacted sustainability.

Achievement of Outputs

Indicator	Degree of achievement
<p>Output 1: Comprehensive management capacity on solid waste management of DPSC is improved. <Degree of achievement is high></p>	
<p>① Master Plan is updated by the end of the Project with two component projects, namely “construction of the new landfill in east and innovation of the workshops for vehicles & heavy machineries” physically completed at the rate of completion of 100% and 100% respectively.</p> <p>② Management process is improved in three aspects.</p> <p>③ Quality of DPSC management-related report on plan, monitoring, and evaluation is improved by establishing two kinds of management reports.</p> <p>④ Core Group: approximately 520 people are trained.</p> <p>⑤ Manuals (Textbooks) are prepared (3 kinds)</p> <p>⑥ Solid waste education is conducted for six elementary schools and two junior high schools of the Popular Council of Miramar through the "Red de Formación Ambiental" while there was no such activity at the beginning of the Project.</p> <p>⑦ Solid waste education for the employees of the hotels and agricultural markets in Havana City is conducted at 10 entities while there was no such activity at the beginning of the Project.</p>	<p>① Partially achieved: Procurement of equipment for vehicle maintenance was completed, however, full completion was not possible due to the delay in starting work on the new sanitary landfill site. Updating of the Master Plan is expected to be completed.</p> <p>② Achieved: Improvements were observed in the three processes of solid waste management planning, monitoring, and evaluation of detailed contents in DPSC and UPPH.</p> <p>③ Achieved: Five management report formats, i.e. i) project planning sheet, ii) project monitoring chart, iii) progress check sheet, iv) minutes of meeting, and v) indicators for project evaluation, resulting in improvement of the quality of reporting.</p> <p>④ Almost achieved: The number of directors of municipalities and communal zones who received training exceeded the target, however, the number of engineers who received training was 91% of the target.</p> <p>⑤ Achieved: Three types of manuals, i.e. “Economical management and management techniques”, “Comprehensive solid waste management”, and “Work safety” were developed.</p> <p>⑥ Achieved: Solid waste management education was conducted at six elementary schools and two junior high schools</p> <p>⑦ Achieved: Training was implemented for the employees of 10 entities.</p>
<p>Output 2: Solid waste source separation at the Pilot Project site is promoted and capacity of UPPH/DPSC in organic waste reduction at the source is strengthened. <Degree of achievement is slightly high></p>	
<p>① Organic waste for composting in Pilot Project Site is collected by 1500 kg per day</p> <p>② Compost in Pilot Project Site is produced to 650 kg per day.</p> <p>③ Percentage of foreign material in organic waste to compost plant is reduced by 50 % as compared to the percentage at the beginning of the project.</p> <p>④ Behavior change of local institutions in Pilot Project Area on waste reduction and separated collection reaches 5 institutions while there was no such institution at the beginning of the project.</p>	<p>① Almost achieved: On average, 1,432 kg per day of organic waste was collected (February-June 2004), however, the amount of collected organic waste varied greatly because it was sometimes necessary for the collection vehicles to be used for general waste collection.</p> <p>② Achieved: On average, 667 kg per day of compost was manufactured between November 2011 - July 2013.</p> <p>③ Partially achieved: The target value regarding the percentage of foreign material in organic waste was 8.3%. In reality, the value was 25.4% at agricultural markets, 2.3% at the tobacco factor, and 0% at hotels. It will be possible to achieve the target in future if collections by UPPH are stabilized.</p> <p>④ Achieved: Five institutions participated in the Pilot Project activities for reducing and separating waste.</p>

Output 3: Capacity of UPPH in the collection and transportation of solid waste is strengthened. <Degree of achievement is high>	
<p>① Average availability (CDT) of working collection vehicles is improved to 63.2% or more; time for repair (TR) is reduced to 8.38 hours per month; and time for waiting to be repaired (TE) is improved to 5.46 hours per month.</p> <p>② Frequency of waste collection and transportation by UPPH is optimized with the index of VF (rate of functioning vehicles to number of collection routes) at 90% and NC (rate of necessity of container to planned number of containers) at 15%.</p> <p>③ In the seven main areas of the maintenance workshop (chassis, welding, machine tool room, tire repair shop, electricity, hydraulics, and injection pump lab), 20 mechanics are trained to correctly operate the equipment donated by the Project.</p> <p>④ Seven technical maintenance manuals are prepared for the main areas of maintenance workshop.</p>	<p>① Achieved: The CDT value was improved to 63.8% (77.5% excluding scrapped vehicles); TR was 6.83 hours per month; and TE was 1.57 hours per month.</p> <p>② Partially achieved: In 2014, the index of VF was 93% (achieved), however, the NC was 20% (not achieved).</p> <p>③ Achieved: All 50 mechanics who received training passed the test of understanding.</p> <p>④ Achieved: 12 types of maintenance manuals were prepared.</p>
Output 4: Capacity of UPPH and DPSC on landfill design and operation of final disposal sites is strengthened. <Degree of achievement is fair>	
<p>① The existing final disposal sites are properly operated and managed in terms of dumping, surface compaction, soil cover, slope protection and leachate treatment at three sites, not only one as at the beginning of the Project.</p> <p>② Design of the new final disposal site is revised in an environmentally friendly way for 11 improvements as opposed to zero at the beginning of the Project.</p>	<p>① Partially achieved: According to monitoring in 2014, some improvements were observed at four final disposal sites, however, proper management was deemed to be implemented at only one final disposal site.</p> <p>② Achieved: 12 improvements were made to the new final disposal site.</p>