People's Republic of Bangladesh

FY2023 External Ex-post Evaluation Report of Grant Aid project

"The Project for Improvement of Solid Waste Management Equipment"

External Evaluator: Hideyuki Takagi, Value Frontier Co., Ltd.

0. Summary

This project addresses the increasing amount of generated waste due to rapid population growth and economic development in the target cities of Dhaka North City, Dhaka South City ("Dhaka North and South Cities"), and Chattogram City,[1] the second-largest city in Bangladesh. The objective of this project is to improve waste collection and transportation capacity in the target cities by procuring waste collection vehicles, thereby contributing to the improvement of local sanitation, the living environment and urban development in Bangladesh.

This project fully aligns with Bangladesh's development policies for improving waste management and meets the development needs of the target cities. Implementing this grant aid project in collaboration with the relevant technical cooperation project has also allowed the project to cover a broad range of measures necessary to improve waste management; therefore, this project was internally coherent with JICA's project. These include preventive maintenance to prevent breakdowns of aging waste collection and transportation vehicles, as well as expanding the capacity of disposal sites. Therefore, its relevance and coherence are high. Procurement of waste collection vehicles, an output of this project, was carried out according to plan. Although project costs were within budget, there were delays in procuring equipment that significantly extended the planned duration of the project. Therefore, the efficiency of the project is moderately low. Overall, the effect of increasing waste collection capacity was achieved as planned, and waste deposited in various street-side locations is currently being collected in a timely manner. The project effect has led to a significant improvement of local sanitation and the living environment, which previously were critical issues. Therefore, the effectiveness and impacts of the project are high. Despite the minor technical and the status of operation and maintenance issues in the operation, maintenance and management of this project, there are high expectations that these will either improve or be resolved. Therefore, sustainability of the project effects is high.

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

[1]At the time of the ex-ante evaluation, the name of the city was Chittagong, but it was renamed Chattogram in 2018.

1. Project Description

Project Locations (Source: External evaluator)

Compactor vehicles in Mirpur garage, Dhaka North City Corporation (Source: Evaluator, February 2024)

1.1 Background

In Bangladesh, a rapid concentration of population and expansion of urban areas has caused urban issues to become more pronounced. Both Dhaka North and South Cities and Chattogram City have seen a consistent up-tick in the amount of generated waste due to a surge in population and economic development. Household waste is collected in dustbins (waste collection points made using concrete blocks) or containers located alongside streets. However, not collecting this waste for extended periods has caused the waste to overflow onto the streets and generate a foul odor, thereby deteriorating the surrounding living environment.

In Bangladesh, residents are responsible for transporting garbage from their homes to these collection points; from there, NGOs and private businesses, who serve as primary waste collectors, use rickshaw vans (tricycles with cargo platforms) to collect household waste. City corporations handle secondary collection, which involves transporting waste from collection points to final disposal sites, but this has been a challenge due to the shortage of equipment necessary to transport the waste.

To resolve this challenge, JICA carried out the grant aid project "The Programme for Improvement of Solid Waste management in Dhaka City toward the Low Carbon Society." This served as a precursor to this project: a total of 112 waste collection vehicles in Dhaka North and South Cities were procured by 2014. As a result of these new vehicles being operational, the amount of collected waste increased but, as 45% of the fleet was still made up of obsolete vehicles manufactured before the year 2000, the waste collection rate had only reached just under 70%.[2] As a consequence, this project was carried out to help improve the sanitation and living

[2] Reference: In Delhi, the capital of neighboring India, 100% of generated waste is collected. Of the waste collected, 47% is processed (such as through incineration, bio methanation, and composting), and 53% is disposed of in landfills (refer to the Delhi Pollution Control Committee website). https://dpcc.delhigovt.nic.in/uploads/pdf/Status-of-Solid-Waste management-in-Delhipdf-83e80619a099843e1cb437a00af5c09d.pdf

environment in Dhaka North and South Cities and Chattogram City where challenges with waste collection and transportation capacity are prevalent.

1.2 Project Outline

The objective of this project is to improve waste collection and transportation capacity in Dhaka North, Dhaka South and Chittagong cities by procuring waste collection vehicles, thereby contributing to the improvement of local sanitation, the living environment and urban development in Bangladesh.

Grant Limit / Actual Grant Amount	1,486 million yen / 1,192 million yen
Exchange of Notes Date / Grant Agreement Date	May 2015 / May 2015
Executing Agencies	Dhaka North City Corporation, Dhaka South City Corporation, Chattogram City Corporation
Project Completion	October 2018
Target Area	Dhaka North City, Dhaka South City, Chattogram City
Main Contractor(s)	Itochu Corporation, FutureBud International Co., Ltd.
Main Consultant(s)	Yachiyo Engineering Co., Ltd.
Preparatory Survey	July 2014 - March 2015
Related Projects	Grant aid project: The Programme for Improvement of Solid Waste management in Dhaka City toward the Low Carbon Society (2009) Technical cooperation project: Project for Strengthening of Solid Waste management in Dhaka North City, Dhaka South City and Chittagong City (2017-2022)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hideyuki Takagi (Value Frontier Co., Ltd.)

2.2 Duration of Evaluation Study

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

Duration of the Study: November 2023 - December 2024

Duration of the Field Study: February 16, 2024 - March 6, 2024

2.3 Constraints During the Evaluation Study

In Dhaka North and South Cities, the target cities for this project, the administrative district

boundaries were expanded further into suburban areas in July 2017. Following this expansion, the population of Dhaka North City grew by 40% and Dhaka South City by 33%. Target values in the ex-ante evaluation sheet were based on the population before the expansion of the city boundaries. It was not possible, therefore, to compare target values with the actual values for quantitative indicators at the time of the ex-post evaluation, which occurred after the expansion. To address this issue, in this ex-post evaluation of whether target values were achieved, estimates of actual values were based on the projected population of the former city area excluding the impact of the population increase due to the expansion of city boundaries.

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

3.1 Relevance/Coherence (Rating: ③[4])

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Bangladesh

Bangladesh's national development policy has positioned improving waste management as a critical issue at the time of both the ex-ante and ex-post evaluations of this project. At the time of the ex-ante evaluation, improving waste management was identified as a critical issue for local governments to address in the *Sixth Five-Year Plan (2011-2015)*, and this project was in alignment with that policy. Similarly, at the time of the ex-post evaluation, activities specifically designed to promote green growth, which were outlined in the *Eighth Five-Year Plan (2020-2025)*, codified the continued need to improve waste management due to the ever-increasing amount of generated waste in major cities.

In regard to waste management policies, at the time of the ex-ante evaluation, the responsibilities of city corporations and other local governments concerning waste collection, disposal, and management related to urban sanitation was stipulated in the *Government of the People's Republic of Bangladesh National Policy for Safe Water Supply & Sanitation 1998*. Furthermore, at the time of the ex-post evaluation, the *Bangladesh National Conservation Strategy 2021-2036* identifies priority actions for urban service providers, including city corporations, concerning urban waste. It specifies appropriate measures for the collection, transportation, disposal and scientific treatment of waste, adequate measures for intermediate collection and final disposal, the 3Rs,[5] special arrangements for handling and processing medical waste, as well as urgent measures to plan for the collection, processing and disposal of electronic waste.

Based on the discussion above, it is clear that Bangladesh's national and sector development policies promote the improvement of waste management in cities such as Dhaka North and

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[4] ④: Very High, ③: High, ②: Moderately Low, ①: Low
[5] The 3Rs refer to the three "R" words: reduce, reuse, and recycle.

South Cities as well as Chattogram City at the time of both the ex-ante and ex-post evaluations of this project. These policies highlight the role of city corporations in urban waste management, thereby being consistent with this project.

3.1.1.2 Consistency with the Development Needs of Bangladesh

At the time of the ex-ante evaluation of this project, the amount of generated waste was continuing to increase due to rapid urban development and population growth. However, this waste was not being appropriately collected and transported, causing an ongoing deterioration of the living environment. Even at the time of the ex-post evaluation, the target cities in this project continue to experience an increased amount of generated waste due to population growth.

Table 1. Changes in the population of the target cities

(Unit: 10 thousand people)

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Dhaka North City	505	526	548	570	591
Dhaka South City	355	374	392	410	428
Sub-total	860	900	940	980	1,019
Chattogram City	349	353	357	361	366

Source and Calculation Method: The population growth rate of Dhaka North and South City from 2018 to 2026 were estimated to be 4% per year in Dhaka North City and 5% per year in Dhaka South City, based on the population estimates of Dhaka North City:4.83 million in 2018, 6.56 million in 2026 and the population estimates of Dhaka South City: 3.37 million in 2018 and 4.82 million in 2026 stated in the NEW CLEAN DHAKA MASTER PLAN 2018–2032. The population growth rate of Chattogram City from 2018 to 2023 was estimated to be 1% per year, based on population estimate of 3.29 million in 2014 from the preparatory survey report for this project and 3.57 million in 2021 from JICA's "Project for Strengthening of Solid Waste management in Dhaka North City, Dhaka South City and Chittagong City" and the evaluator assumed that annual population growth rate was constant.

Table 2. Changes in the waste generation volume of the target cities

(Unit: Tonnes/Day)

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Dhaka North City	3,924	3,966	4,008	4,049	4,091
Dhaka South City	3,058	3,101	3,143	3,186	3,230
Sub-total	6,982	7,067	7,151	7,235	7,321
Chattogram City	2,224	2,250	2,276	2,302	2,328

Source and Calculation Method: For Dhaka North and South Cities, the estimated amount of generated waste is based on the JICA's (technical cooperation) "Project for Strengthening of Waste management in Dhaka North City, Dhaka South City and Chittagong City." For Chattogram City, these are based on the Waste Reports 2019-2020. The evaluator has calculated annual estimates for both of the cities by calculating the amount of generated waste per capita and then multiplying it by the population projections estimated in Table 1.

While the amount of generated waste was increasing, waste collection vehicles in the target cities were becoming obsolete, and it was necessary to address the decline in waste collection capacity that resulted from the reduced number of operational vehicles. Many obsolete waste collection vehicles in the target cities at the time of the ex-ante evaluation have been scrapped,

and this project addressed that issue by renewing the vehicles. Going forward, the target cities need to maintain enough waste collection vehicles in operational condition to properly manage the increasing amount of waste.

Table 3. Changes in the number of waste collection vehicles in the target cities before and after the project

(Unit: Number of vehicles)

	Dhaka North City	Dhaka South City	Chattogram City
Number of vehicles at the time of ex-ante evaluation (2015)	139	200	79
Procured in this project	56	56	38
Number of vehicles disposed of	87	144	57
Number of vehicles procured other than through this project	38	170	83
Number of vehicles in operation at the time of ex-post evaluation (2024)	146	282	143

Source: Documents provided by JICA and the executing agencies

In addition to the vehicles renewed through this project, there is further procurement with Bangladeshi funds in each target city to handle the increase in generated waste. As the oldest part of the city, Dhaka South City, in particular, has many areas with narrow streets. This requires a sizable number of small dump trucks, and the number of vehicles significantly increased following the expansion of the city boundaries.

As evident from the above, there has been a continuous increase in the amount of generated waste at the time of both the ex-ante and ex-post evaluations in the target cities. Waste collection vehicles need to be renewed and to increase in number, which is consistent with development needs.

3.1.1.3 Appropriateness of the Project Plan and Approach

The ex-ante evaluation of this project highlights a lesson learned from similar projects. When constructing grant aid projects, it is important to collaborate with technical cooperation projects and, at the same time, continue to create projects that have both a high possibility of serving as model projects and can also demonstrate ripple effects and visibility. Based on this lesson, in this project, target cities were offered support for both equipment procurement and technical capabilities in collaboration with the technical cooperation project “Project for Strengthening of Waste management in Dhaka North City, Dhaka South City and Chittagong City” (2017-2022), as discussed later in section 3.1.2.2 Internal coherence.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

This project is consistent with Japan's Country Assistance Program for Bangladesh at the time of the ex-ante evaluation (June 2012) (the support policy for the waste sector included in the priority area of urban development), and one of the key issues of promoting urban development to accelerate economic growth, as identified in the JICA Country Analysis Paper (April 2013).

3.1.2.2 Internal Coherence

As previously mentioned in section 3.1.1.3, the JICA technical cooperation project, "Project for Strengthening of Waste management in Dhaka North City, Dhaka South City and Chittagong City" (2017-2022), was planned and carried out to address various challenges related to waste management in the target cities in collaboration with the technical support provided through this project. Notable points for the effects of the technical cooperation project include the positioning of the *New Clean Dhaka Master Plan 2018-2032* as the basic plan for future waste management projects in Dhaka North and South Cities,[6] the introduction and continuation of preventive maintenance through routine and periodic inspections of waste collection vehicles, the extension of the landfill life by two years enabled by improvements in the operation of waste disposal sites, and the improved hygiene habits of residents prompted by public information campaigns about waste collection and disposal. The resulting synergies of the technical cooperation project and the improvement of waste collection capacity by this project have enabled the effective collection and disposal of waste in the target cities in accordance with urban planning and have also led to an improvement of local sanitation and the living environment for residents of these areas.

3.1.2.3 External Coherence

In the target cities for this project, support for improving waste management was provided by the Asian Development Bank (ADB) through the "Urban Public and Environmental Health Sector Development Project" (2009–2021) and the "Urban Primary Health Care Services Delivery Project" (2012–2024). In these projects, support was provided to construct secondary transfer stations (STS), which later led to city corporations promoting the construction of these stations. The ADB projects successfully constructed 25 of the initially planned 46 STS. The cities have continued to construct STS, resulting in 46 in Dhaka North City, 63 in Dhaka South City, and 6 in Chattogram City (with an additional 4 currently under construction). Furthermore,

[6] For Chattogram City, the Waste Reports 2019-2020 was created to summarize the current state of the city's waste management as a preliminary step in the waste management master plan.

providing rickshaw vans and plastic garbage bins has improved primary collection services, leading to an increase in the amount of waste collected and an expansion of collection areas. The synergy created between the ADB projects and this project has improved urban public and environmental health and facilitated broader participation by the population in supporting impoverished groups.

From the above, the project was carried out with an appropriate and effective approach to address the serious challenges faced by major cities in Bangladesh. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The outputs of this project for the three target cities were procuring waste collection vehicles, providing consulting services for managing this procurement, and offering technical support so that procured equipment could be seamlessly introduced as well as operated and managed appropriately.

3.2.1.1 Procurement and Consulting Services

Waste collection vehicles were procured according to plan.

Table 4. Number of waste collection vehicles procured

(Unit: Number of vehicles)

Waste collection vehicles	Dhaka North City	Dhaka South City	Chattogram City	Total
Compactor (small)	10	8	6	24
Compactor (large)	13	14	7	34
Container Carrier	20	24	13	57
Dump truck (small)	4	3	4	11
Dump truck (large)	5	4	4	13
Dump truck (4WD)	4	3	4	11
Total	56	56	38	150

Source: Documents provided by JICA

Photo 1. Transshipment of waste to a compactor vehicle by primary collector (Source: Evaluator, March 2024)

Photo 2. A container carrier in Sagarika vehicle maintenance station, Chattogram City Corporation (Source: Evaluator, March 2024)

3.2.1.2 Technical support

The following technical support was planned and implemented in this project with the aim of achieving the plan to improve waste collection capabilities through the seamless introduction and the appropriate operation and management of equipment.

1. Support in creating dispatch plans for introducing compactor vehicles

The following initiatives were implemented in order for staff in target cities to draft dispatch plans that establish the collection times and locations for compactor vehicles, that are suited to conditions in the areas that they serve, and that facilitate the introduction of vehicles by the staff according to these plans.

- Preparation before introducing vehicles: Shortlisting potential locations to introduce the vehicles, conducting on-site surveys in these locations, creating dispatch plans, creating leaflets that explain the collection times and locations, and discussing dispatch plans
- Introduction of new vehicles: Offering guidance to primary collectors, discussing and coordinating collection times and locations with residents, and follow-up after the introduction of the vehicles

The following initiatives were implemented in order for drivers and workers to receive safety education and guidance on loading waste so that waste collection is carried out appropriately.

- Creating leaflets for safety guidance
- Offering safety guidance to drivers, offering guidance on loading waste to workers

2. Improving operations and management of vehicle repair shops and the skillset of mechanics

The following initiatives were implemented in order to improve the management system for vehicle repair shops.

- Drafting overall management plans, work (task) manuals, work plans, and budgets for

vehicle repair shops

- Providing operations and management as well as training on regulations for vehicle repair shops (a total of three sessions attended by 73 employees)

The following initiatives were implemented in order to improve mechanics' vehicle maintenance and management skills so that vehicles are appropriately maintained.

- Holding training for mechanics (one session attended by 15 mechanics)

Regarding technical support for vehicle repairs, although on-site surveys confirmed that routine maintenance was ongoing, mechanics shared that JICA's technical cooperation projects and technical support for this project did not include repairing the hydraulic and electrical systems in compression equipment (a skill used in the maintenance of compactor vehicles) and that there was a lack of knowledge and experience in these areas.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost was 1.525 billion yen, and the actual cost was 1.272 billion yen, which means that the expenses were within budget (83% of the planned amount). The factor influencing the lower actual cost compared to the planned project cost for equipment procurement (318 million yen difference) was price competition in the bidding process which led to the successful bidder reducing their fees.

- Project cost for Japan: The planned project cost was 1.486 billion yen. The actual cost was 1.192 billion yen (contract amount for equipment procurement: 1.168 billion yen in total, additional expenses for storing equipment in Japan: 24 million yen in total) (Project cost was around 80% of the budget). The funds saved in procuring the equipment were allotted to the additional expenses for storing equipment in Japan, which were incurred due to the delay in Bangladesh issuing the Authorization to Pay (A/P) (mentioned later in 3.2.2.2 Project Period).
- Project cost for Bangladesh: The planned project cost was 39 million yen. The actual cost was approximately 80 million yen. The unit cost for procuring container carriers was higher than planned (approximately 18 million Bangladeshi Taka (BDT) for Dhaka North City Corporation, approximately 22 million BDT for Dhaka South City Corporation, and approximately 12 million BDT for Chattogram City Corporation). (Project cost was around 205% of the budget.)

3.2.2.2 Project Period

The planned project period was 22 months, while the actual period was 42 months and significantly longer than planned (191% compared to the plan). The factor influencing this

prolonged project period was the extension of the shipping deadline by nine months, caused by the delay in Bangladesh issuing the A/P. The delay in the A/P was due to the executing agencies' failure to finish drafting and approving the detailed project proposal (DPP), which was itself influenced by the time required to coordinate and compile administrative procedures concerning the technical matters in the three target cities. There was also a three-month delay in the conclusion of the consulting contract and an eight-month delay in the bidding procedure in relation to bidding documents and technical specifications.

Although the project cost was within the plan, the project period significantly exceeded the plan due to delays in the procurement of equipment. Therefore, efficiency of the project is moderately low.

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

3.3.1. Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

No operation indicators were established as quantitative effect indicators in the project's ex-ante evaluation sheet. Therefore, in the ex-post evaluation, these 1. Operation Indicators related to waste collection capacity were also established as subsidiary indicators: the "utilization rate of waste collection vehicles (%)" and the "number of waste collection vehicles in operation (number of vehicles)." The waste collection capacity of each of the target cities was confirmed with these operation indicators. Subsequently, it was confirmed whether the targets for the 2. Effect Indicator: "waste collection amount (tonnes/day)" (established in the ex-ante evaluation sheet) had been achieved.

1. Operation Indicators (Established as subsidiary indicators for this ex-post evaluation)

In 2021, three years after the completion of the project, the utilization rate of waste collection vehicles provided by the project stood at 100%, achieving targets in all three target cities. Additionally, the number of waste collection vehicles in operation exceeded expectations at the time of the ex-ante evaluation. This is due to the executing agencies procuring additional vehicles using the cities' budget or budget allocations from the government to address the expansion of the boundaries of Dhaka North and Dhaka Cities that took place in July 2017.[8]

[7] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

[8] After the expansion of the cities' boundaries, the population increased by 40% in DNCC and by 33% in DSCC. Land area increased by 137% in DNCC and 142% in DSCC.

Table 5. Achievement of the operation indicators

	City	Baseline	Target[1]	Actual				
		2014	2019	2019	2020	**2021**	2022	2023
			3 years after completion	1 year after completion	2 years after completion	**3 years after completion**	4 years after completion	5 years after completion
Indicator 1 Utilization rate of waste collection vehicles[2] (%)	Dhaka North City	–	97	100	100	**100**	100	98
	Dhaka South City	–	97	100	100	**100**	100	100
	Chattogram City	–	97	100	100	**100**	100	100
Indicator 2 Number of waste collection vehicles in operation (# of vehicles)	Dhaka North City	–	119	136	156	**154**	146	146
	Dhaka South City	–	143	289	289	**289**	289	282
	Chattogram City	–	109	104	111	**124**	130	143

Source: Documents provided by the executing agencies

Note:

1. Target values are listed according to estimates at the time of the ex-ante evaluation (calculated this to be 97% in all three target cities, giving consideration to regular standby and repair days).
2. This indicates the utilization rate of waste collection vehicles procured through this project. Actual values at the time of the ex-post evaluation indicate the number of vehicles in operation/total number of vehicles, as data on standby and repair days have not been obtained.

2. Effect Indicators

In 2021, three years after the completion of the project, the target values for the effect indicator "waste collection amount (tonnes/day)" was achieved in one city and mostly achieved in two cities. More specifically, Dhaka North City achieved the target value (actual value was 126% of the target value), and Dhaka South City and Chattogram City both mostly achieved the target values (actual values were 85% and 86% of the target values, respectively). It is worth noting that the actual values for the amount of waste collected includes the impact of the additional waste collection vehicles procured by executing agencies, which is referred to above in the context of "number of waste collection vehicles in operation."

Table 6. Achievement of the effect indicators

	City	Baseline	Target[1]	Actual				
		2014	2019	2019	2020	**2021**	2022	2023
			3 years after completion	1 year after completion	2 years after completion	**3 years after completion**	4 years after completion	5 years after completion
Indicator 1 Waste collection amount (Tonnes/Day)	Dhaka North City	1,356	2,040	2,301	2,454	**2,575**	2,695	2,799
	Dhaka South City	1,991	2,475	2,031	2,108	**2,109**	2,185	2,261
	Chattogram City	1,200	1,862	1,300	1,550	**1,600**	1,850	1,900

Source: Documents provided by the executing agencies. City corporations measured the load weight using truck scales installed in final disposal sites and kept electronic records of these measurements.

Note: The following calculation method was applied to calculate the estimated actual amount of waste collected, which excludes the impact of the population increase due to the expansion of Dhaka North and South Cities and verify whether targets for the effect indicator were achieved.

Calculation Method: Actual amount of waste collected in the current city area of Dhaka North and South Cities (after the expansion) x percentage of the estimates of the population of the former city area based on the population by ward in the 2022 Census (refer to Table 7 below).

Table 7. Actual waste collection in the current city area and estimates of the population of the former city area

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Dhaka North City					
Actual waste collection in the current city area (Unit: Tonnes/Day)	3,123	3,241	3,318	3,396	3,457
Estimates of the population of the former city area (1,000 people)	3,719	3,986	4,254	4,521	4,789
Dhaka South City					
Actual amount of waste collected in the current city area (Unit: Tonnes/Day)	2,700	2,800	2,800	2,900	3,000
Estimates of the population of the former city area (1,000 people)	2,673	2,812	2,950	3,089	3,227

Source: Actual amount of waste collected in the current city area was based on materials provided by the executing agencies. Estimates of the population of the former city area were made by (1) calculating the 2018 population of the former city area by dividing the estimated 2018 population stated in the *NEW CLEAN DHAKA MASTER PLAN 2018–2032* with the population growth rate to account for the cities' expansion (140% for Dhaka North, 133% for Dhaka South), (2) calculating the 2022 population of the former city area using the Population and Housing Census 2022, and (3) calculating the population of the former city area of Dhaka North and South Cities from 2019-2021 and in 2023 assuming the annual population growth rate for these years to be consistent.

3.3.1.2 Qualitative Effects (Other Effects)

In the ex-post evaluation of this project, the qualitative effect "improvements in the sanitation, living environment, and health conditions of residents in the target areas" included in the ex-ante evaluation sheet have been summarized as the qualitative impact of the project.

3.3.2 Impacts

3.3.2.1 Intended Impacts

1) Quantitative impact

Three years after the completion of the project, the target values for the quantitative impact indicator "waste collection rate (%)" established in the ex-ante evaluation of this project were achieved in one city and mostly achieved in the other two cities. More specifically, Dhaka South City achieved the target value (actual value was 119% of the target value), and Dhaka North City and Chattogram City both mostly achieved the target values (actual values were 98% and

71% of the target values, respectively). The waste collection rate in each of the target cities has continued to show improvement over time.

Table 8. Achievement of the quantitative impact indicators

	City	Baseline	Target[1]	Actual				
		2014	2019	2019	2020	**2021**	2022	2023
			3 years after completion	1 year after completion	2 years after completion	**3 years after completion**	4 years after completion	5 years after completion
Indicator 1 Waste collection rate (%)	Dhaka North City	65	85	80	82	**83**	84	84
	Dhaka South City	66	75	88	90	**89**	91	93
	Chattogram City	75	98	58	69	**70**	80	82

Source and Calculation Method: The figures are estimates calculated based on the estimated amount of generated waste introduced in the paragraph relevant to development needs in the "Relevance" section, and the waste collection amount data recorded by each city corporation introduced in the paragraph relevant to effect indicators in the "Effectiveness" section.

2) Qualitative impact

In the post-ex evaluation of this project, surveys[9] were conducted with local residents in each area of the three cities to verify the qualitative effect "improvements in the sanitation, living environment, and health conditions of residents in the target areas." The following is a summary of the survey results.

Improvements in the sanitation and living environment:

Dustbins have been removed and the locations of containers have been reviewed and, since around 2017, progress has been made with building STS. Compared to the situation before the project, there has been a significant reduction in the disposal of waste on roads, in drainage ditches, on vacant land, and in waterways due to the daily collection of waste from STS, the expansion of collection areas for primary collectors, and the introduction of waste collection at set times and locations using compactor vehicles.

In addition to this project, city corporations have installed public toilets. Notably, in Dhaka South City, spraying insecticides to prevent mosquito outbreaks in low-income settlements located along waterways has also resulted in a decrease in pests such as flies. Given these factors,

[9] Dhaka North City —Around Jhilpar STS: Interviewed a primary waste collector, a food service employee, low-income households (group interview), and two nearby residents. Around Rainkhola STS: Interviewed an STS employee, a primary waste collector, a food service employee, and two nearby residents. Dhaka South City—Around Khilgaon STS: Interviewed a food stall owner and customer, a primary waste collector, a wood factory worker, three hospital administrators (Royal Aid Hospital), and three low-income households (group interview). Chattogram City—Around Panthokunjo STS: Interviewed a group of three primary waste collectors, a food stall customer, a market shop owner and two customers, and a food service employee. Around South Halishahar STS: Interviewed three primary waste collectors, and a shop employee. Around Port Market: Interviewed a nearby resident, a hospital administrator, a restaurant owner and an employee, three low-income households (group interview), and a district resident waste manager. In the Sagarika area: Interviewed about five community people where garbage is collected about once every three days (group interview).

the sanitation conditions and the overall living environment have improved. However, as mentioned later in "Other Positive and Negative Impacts," the issue of illegal waste disposal in low-income settlements is yet to be addressed.

Improvements in the health condition of residents:

While sanitation and the living environment have improved as discussed above, it is unclear whether these improvements have managed to reduce the prevalence of diseases. There are still annual outbreaks of waterborne diseases, such as cholera, during the monsoon season, attributable to various causes including the contamination of tap water from illegal connections to the water network. There is no evidence to confirm that the implementation of this project has reduced the number of cases of these diseases.[10]

3.3.2.2 Other Positive and Negative Impacts

1) Impact on the Environment

At the time of the ex-ante evaluation, this project was determined to have minimal adverse impact on the environment and society and was classified under Category C for environmental and social considerations according to JICA's *Guidelines for Environmental and Social Considerations* published in April 2010. As of the time of the ex-post evaluation, this project has shown to have no adverse impact on the environment, based on discussions with the executing agencies and interviews with residents in the target areas.

2) Resettlement and Land Acquisition

Not applicable.

3) Gender Equality, Marginalized People, Social Systems and Norms, People's Well-being and Human Rights

The waste collection rate in the target cities has improved as a result of this project and other support from JICA and other donor parties, as well as the efforts of city corporations; waste is currently being collected even in low-income residential areas that previously had no waste collection.

However, illegal disposal still continues to occur especially in low-income settlements located along waterways, and many citizens hope that these conditions will improve. According to interviews with residents in the target areas, there have been instances where city corporations

[10] Resources: WHO website: https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON426, Dhaka Tribune news article (April 22, 2022): https://www.dhakatribune.com/bangladesh/269290/cabinet-cholera-situation-in-dhaka-worst-in-last

did not allow residents of these settlements to bring household waste to the STS because they had not paid the collection fee. This suggests that there is room for improvement in how the administration handles waste from these settlements. There are also issues related to safety and hygiene for primary collectors who use rickshaw vans for household waste collection. These collectors are prone to injuries due to inadequate workwear (for example, wearing sandals), exposure to vehicle exhaust which causes eye damage when transferring and reloading waste, and not being vaccinated against tetanus.

4) Unintended Positive / Negative Impacts

Increasing the number of waste collection vehicles allowed for waste to be collected from STS on a daily basis, which has raised citizens' awareness of appropriate waste disposal. According to interviews with residents in the target areas conducted for this ex-post evaluation, many residents have become positive about paying waste collection fees since the streets have become cleaner and clear of litter. (Additional note: The cleanliness of the streets is not only due to the improvement of the waste collection system but also largely attributable to the daily presence of the cleaning staff in each city.)

This project has mostly achieved its objectives and serious waste management issues have been significantly improved. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

The waste management policies and systems in Bangladesh are described below. The sustainability of the effects of this project, which designates the city corporations as entities responsible for waste management, are being maintained in terms of its policy and system.

1. Local Government Law 2009

The law stipulates the responsibility of local governments for the collection, transport, and processing of waste. In 2009, new provisions were added to designate city corporations as the entities responsible for waste management in metropolitan areas.

2. New Clean Dhaka Master Plan[11]

[11]The plan revised the master plan for waste management, which had set 2015 as the target year, in a precursor project through JICA's activities in their "Project for Strengthening of Waste Management in Dhaka North City, Dhaka South City and Chittagong City" (2017-2022). Further, in Chattogram City, the Waste Reports 2019-2020 (annual reports) were created to inform residents about the situation regarding waste along with the relevant efforts from Chattogram City Corporation.

Master plans have been created respectively for both Dhaka North and South Cities as basic plans that outline future waste management projects over a 15-year period, setting 2017 as the base year and 2032 as the target year.

3. Solid Waste Management Rules 2021

These rules were enacted with the primary focus on curbing waste generation. It stipulates the waste separation responsibilities for those who produce waste and the administration, as well as the introduction of extended producer responsibility.[12] It also stipulates that local governments are required to perform separate waste collection and manage waste comprehensively, in a way that includes reducing waste, recycling and composting.

As a means to comply with the *Solid Waste Management Rules 2021* in each of the target cities, Dhaka North City has announced an additional policy to incinerate waste from in-progress construction projects and use it to generate energy. The city has implemented the concept of extended producer responsibility and stated that it will work on managing construction waste. Dhaka South City is promoting the separation of waste at its source as well as the 3Rs and has implemented extended producer responsibility. Chattogram City is promoting the separation of waste at its source, the 3Rs and composting.

Based on the above, there is no issue in terms of the sustainability of policy and system of the project.

3.4.2 Institutional/Organizational Aspect

3.4.2.1 Responsible Agency

The Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Co-operatives supervises waste management in the target cities. The LGD is responsible for local government systems, organizations, and segregation of duties and is the responsible agency for water supply and sanitation sectors. As strategic objectives and key activities for waste management, the LGD establishes that city corporations and local governments are responsible for: collecting, processing and managing household waste; constructing sanitary landfills; and collecting and managing hospital waste.

3.4.2.2 Executing Agencies

In the target cities, where each city corporation is responsible for waste management within its boundaries, the required number of staff as determined in the preparatory survey for this project have been allocated to the waste management departments. Interviews with city

[12]The concept that extends producer responsibility to the disposal and recycling stages of a product. The Organisation for Economic Co-operation and Development (OECD) updated the Guidance Manual for Governments on Extended Producer Responsibility in 2016. (Refer to the website of the National Institute for Environmental Studies)

corporations also confirmed that there are no significant issues in the institutional aspect.

1. Dhaka North City Corporation

A Waste Management Department has been established, and it has around 300 staff.

2. Dhaka South City Corporation

A Waste Management Department has been established, and it has around 330 staff.

3. Chattogram City Corporation

The Waste Management Department has not yet been established, but the Cleaning Department has approximately 160 staff.

In addition, in both North and South Dhaka Cities, a "ward-based approach" (WBA) has been introduced for waste management projects. The Waste Management Department is responsible for planning and managing the entire project, while the heads of the cleaning offices established in each ward act as cleaning supervisors, carrying out on-site waste management initiatives at the ward level.

Based on the above, there is no issue in terms of the sustainability of the organizational and institutional aspects of the project.

3.4.3 Technical Aspect

As shown below, the technical aspects of operation, maintenance and management of waste in the three target cities satisfy the required standards, aided by the effects of collaboration with JICA's technical cooperation projects.

1. Dhaka North City Corporation

Vehicle maintenance is conducted in a vehicle repair shop near Aminbazar disposal site. Gabtoli repair shop was used until March 2024 but a newly created vehicle repair shop located near the disposal site is now being used. The Technical Department performs all maintenance on waste collection vehicles.

2. Dhaka South City Corporation

The Technical Department performs all maintenance on waste collection vehicles using parking and other spaces at the Matuail disposal site.

3. Chattogram City Corporation

The Machine Technical Department performs all maintenance on waste collection vehicles at the Sagarika disposal site.

In each city, the mechanics who perform vehicle maintenance have sufficient knowledge and experience to perform both routine and periodic maintenance. Mechanics repair the engines, actuator parts and bodies of aging vehicles at vehicle maintenance workshops, enabling ongoing use of these vehicles. Additionally, this project's technical support and collaboration with the

technical cooperation project have introduced preventive maintenance with routine and periodic inspections. This has also facilitated the formulation of occupational safety and health regulations as well as work regulations for vehicle repair shop staff, which have been put into practice on-site at each of the target cities.

The drivers and assistants of waste collection vehicles keep a preventive maintenance manual, written in Bengali, inside the vehicle and use it for daily inspections and maintenance. However, the current situation of vehicle maintenance workshops is limited to repair the engines, actuator parts and bodies of aging vehicle by skilled mechanics relying on their experience to perform daily tasks, with no established system for training or effective use of manuals. As opportunities to improve technical skills, including those for young staff, are limited to on-site on-the-job training (OJT), the staff have not received adequate training for the maintenance of special vehicles such as compactor vehicles that are mounted with compression equipment.

Photo 3. Repairing the driveshaft of a compactor vehicle at Gabtoli vehicle maintenance station, Dhaka North City Corporation (Source: Evaluator, March 2024)

Based on the above, there are minor issues regarding sustainability of the technical aspect. There are high expectations for improvements to the maintenance of compression equipment in compactor vehicles, as vehicle repair shop managers have indicated plans to address the issue by effective future use of manuals.

3.4.4 Financial Aspect

Waste management expenditure has increased and continues to increase compared to before the start of the project in all three target cities. According to interviews with each city corporations, the budget required for operation and maintenance is not sufficient, and it is about 70% of the required amount. For the purpose to continue current waste management, the target cities are making efforts to lower maintenance costs, including utilization of machine tools to manufacture parts of the vehicle body in-house. In addition, city corporations are procuring new waste collection vehicles with city or national budgets amid the increase in generated waste due to population growth, and the expectation is that current waste collection and transportation will continue.

Table 9. Changes in waste management expenditure in target cities

(Unit: Million BDT)

City	At the time of ex-ante evaluation	After the completion of this project				
	FY 2014	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Dhaka North City	1,375	2,431	2,560	3,202	2,663	2,996
Dhaka South City	1,935	1,900	1,975	2,150	2,400	2,530
Chattogram City	501	620	730	750	760	780

Source: Documents provided by the executing agencies.

Based on the above, no particular issues have been observed regarding the sustainability of the financial aspect.

3.4.5 Environmental and Social Aspect

At the time of the ex-ante evaluation of the project, no negative environmental or social impact had been anticipated in the short term and, as of the time of the ex-post evaluation, no negative environmental or social impact has been recognized in any of the three target cities.

3.4.6 Preventative Measures to Risks

At the time of the ex-ante evaluation of the project, the precondition for implementing the project established that city corporations would secure the budget and staff required for the operation, maintenance and management of relevant equipment. The ex-ante evaluation also mentioned cases in similar past projects where the amount of generated waste exceeded the capacity of disposal sites. In response to these expected risks, the project has carried out measures including tackling the issue of aging waste collection and transportation vehicles through preventive maintenance, as well as expanding the capacity of disposal sites through collaboration with the technical cooperation projects as discussed above in 3.1.1.3. Therefore, there are no issues because risks have been addressed.

3.4.7 Status of Operation and Maintenance

At the time of the ex-post evaluation, the situation regarding the waste collection vehicles procured in this project was as follows: in Dhaka North City, one small compactor had been scrapped; in Dhaka South City, one small dump truck was under repair following an accident; and in Chattogram City, all vehicles were operational. Almost all waste collection vehicles were in operational condition.

However, interviews with mechanics and drivers at vehicle repair shops conducted during the ex-post evaluation revealed concerns about a possibly shortened service life for vehicles because of not using genuine parts for maintenance, for example issues caused by the size of non-genuine,

badly-fitting air filter replacements. In each city corporation, non-genuine parts that are distributed in Bangladesh are misused to maintain waste collection vehicles. Interviews with each city corporation revealed that they take advantage of the price difference[13] between genuine and non-genuine parts to lower costs. As non-genuine parts are more widely distributed in the local market, they are also seen as more convenient.

Based on the above, there are minor issues regarding operation, maintenance and management. There are high expectations for improvement regarding the use of genuine parts, as the executing agencies and the LGD (the responsible agency) have indicated their intention to make necessary efforts.

Slight issues have been observed in the technical aspects and the current status of operation and maintenance. However, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project addresses the increasing amount of generated waste due to rapid population growth and economic development in the target cities of Dhaka North City, Dhaka South City, and Chattogram City, the second-largest city in Bangladesh. The objective of this project is to improve waste collection and transportation capacity in the target cities by procuring waste collection vehicles, thereby contributing to the improvement of local sanitation, the living environment and urban development in Bangladesh.

This project fully aligns with Bangladesh's development policies for improving waste management and meets the development needs of the target cities. Implementing this grant aid project in collaboration with the relevant technical cooperation project has also allowed the project to cover a broad range of measures necessary to improve waste management; therefore, this project was internally coherent with JICA's project. These include preventive maintenance in relation to aging waste collection and transportation vehicles, as well as expanding the capacity of disposal sites. Therefore, its relevance and coherence are high. Procurement of waste collection vehicles, an output of this project, was carried out according to plan. Although project costs were within budget, there were delays in procuring equipment that significantly extended the planned duration of the project. Therefore, the efficiency of the project is moderately low. Overall, the effect of increasing waste collection capacity was achieved as planned, and waste deposited in

[13] The cost of non-genuine parts, including air filters, is approximately 70-90% of genuine parts (in the case of Hino trucks) (using information from the parts price list from DNCC).

various street-side locations is currently being collected in a timely manner. The project effect has led to a significant improvement of local sanitation and the living environment, which previously were critical issues. Therefore, the effectiveness and impacts of the project are high. Despite the minor technical and the status of operation and maintenance issues in the operation, maintenance and management of this project, there are high expectations that these will either improve or be resolved. Therefore, sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

1. Improving management of data about waste management: The administration does not appropriately manage or track the data that it needs, including the amount of generated waste and the waste collected by city corporations and private collectors. It is recommended to improve the management of data necessary for evaluating policies and budget allocations, take advantage of the data to further improve waste management, and form a waste management administration capable of achieving self-sustaining development.
2. Procuring genuine parts: Non-genuine replacement parts distributed in Bangladesh are selected, procured and misused to maintain the project's waste collection vehicles. Experienced mechanics who maintain the vehicles have highlighted that these non-genuine parts are not always compatible with the vehicles (for example, air filters are not the appropriate size for the vehicles) or are of inferior quality, with a potential reduction in the service life of these vehicles. In terms of the cost-effectiveness of genuine parts versus the cost to repair or procure new vehicles, it is recommended to use genuine parts where using non-genuine parts would cause maintenance issues.
3. Improving maintenance skills for special vehicles: Compactor trucks, which have only been in use in Bangladesh for a short time, require maintenance skills that differ from those of regular waste collection and transportation vehicles. The mechanics who maintain these vehicles lack knowledge and experience, especially in repairing the hydraulic and electrical systems of compression and other equipment (which are part of the compactor function). It is recommended that vehicle repair shop managers conduct training for mechanics using the maintenance manuals provided in this project and work toward improving the skills of mechanics in repairing hydraulic and electrical systems in compression and other equipment.
4. Improving the work environment of primary collectors: Although primary collectors who use rickshaw vans for household waste collection have a crucial role in the current waste management system, there are unaddressed safety and hygiene issues including: primary collectors with inadequate workwear (for example only wearing sandals) being prone to

injuries; being exposed to vehicle exhaust which damages their eyes when transferring and reloading waste, and not being vaccinated against tetanus. It is recommended that the administration focus on enhancing efforts for the workplace safety and health of primary collectors.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

1. Establishing and Confirming the System to Implement the Project in Advance: In regard to the project procurement, the shipping deadline was extended by nine months due to the delay in Bangladesh issuing the A/P that resulted in additional expenses for storing equipment. The factor influencing the delay in Bangladesh issuing the A/P was the failure to finish drafting and approving the detailed project proposal (DPP). The reason for the delay in the creation of the DPP was interruptions to the coordination among the three target cities of Dhaka North and South Cities as well as Chattogram City. When carrying out future projects in Bangladesh, especially those involving multiple target cities, it is recommended that the country establishes a system that facilitates the start to the implementation of the project, such as by appointing project managers, and that JICA communicates closely with relevant agencies to confirm this system as well as the workflow and schedule, in order to ensure uninterrupted administrative coordination for technical matters.
2. Preparation to Procure Genuine Parts: Non-genuine parts distributed in Bangladesh are being misused to maintain waste collection vehicles. However, using non-genuine parts that are not compatible with the vehicle, including incorrectly sized parts, has the potential to reduce the service life of vehicles. For this reason, it is recommended that the executing agencies procure genuine parts from the authorized dealers within Bangladesh that are designated by suppliers and manufacturers. The LGD (the responsible agency) and other related organizations need to recognize the necessity for genuine parts and update budgets accordingly. It is recommended that when carrying out future projects to maintain special vehicles such as waste collection vehicles, the related organizations, including JICA, and the responsible/executing agencies discuss and confirm during the planning and implementation of the project the requirement to procure genuine parts.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

This project introduced waste collection at set times and locations using compactor vehicles in Chattogram City for the first time. For this reason, in providing the support to aid the smooth introduction of compactor vehicles and support in relation to safety guidance, JICA consultants paid particular attention to evaluating the areas where the vehicles would be introduced, consulted stakeholders, and offered guidance to drivers and workers. The outcome of this support is enabling the continued operation of the compactor vehicles today. (From interviews with compactor vehicle drivers and primary collectors in Chattogram City)

5.2 Additionality

To date, JICA has provided continuous support for waste management in Bangladesh, with a focus on Dhaka North and South Cities. Additionally, JICA provides waste management support in various countries under its Clean City Initiatives. Given this background, visits to Dhaka City are conducted as part of the third-country training program in the technical cooperation project "Juba Clean City Project" for South Sudan (August 2022 to July 2026). Furthermore, through collaboration with the above project and the grant aid project "Solid Waste Management Master Plan in Juba City" (October 2021 to July 2025), this project intends to share outcomes related to formulating a waste management master plan, maintaining and managing waste collection vehicles, improving waste disposal site operations, and public information campaigns for waste management.

(End)