People's Republic of Bangladesh

FY2019 Ex-Post Evaluation of Japanese Grant Aid Project

"The Improvement of the Capacity of Public Food Storage"

External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

The objective of this project was to increase storage capacity by the construction of a rice warehouse in the Bogra district, a granary area located in the north-western part of Bangladesh, thereby contributing to a stable food supply and food security nationwide, including in disaster periods. At the planning phase and at the ex-post evaluation, it was the policy of the Bangladeshi government to enhance and maintain food grain storage facilities. At the ex-post evaluation, the existing facilities needed to be rebuilt while the Bangladeshi government was increasing the amount of rice supply through its food programs. The scope of this project was also consistent with the aid policies of Japan. Therefore, its relevance is high. A solar power system was added to the scope of the project. Taking into consideration the additional project scope, the project cost was within the plan and the project period was as planned. Therefore, efficiency of the project is high. Regarding the achievement level of the quantitative indicators, the "Inventory turnover" was mostly achieved, but achievement of "Storage amount of rice" and "Frequency of pest control" were moderate. It was difficult to analyze the impact quantitatively. However, the warehouse shipped rice to a wide area and was also being used to stock wheat at the ex-post evaluation. Thus, effectiveness and impacts of the project are fair. In terms of the institutional/organizational aspect, although staff numbers were slightly tight, this issue did not affect warehouse operations severely. For the technical aspect, periodic training was an issue. For the financial aspect, an increase in the organizational budget did not reach the requirement estimated at the planning phase, though the organizational budget was increasing. In the status of the operation and maintenance, no serious damage to the project effects was found. For the above reasons, sustainability of the project effects is fair.

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

1. Project Description

Project Location


The warehouse constructed by this project

1.1 Background

At the end of the 2000s, when this project was formulated, Bangladesh had a population of 146.6 million people (preliminary figure in July 2009). It was estimated that approximately 40% of the population did not have access to sufficient food due to poverty. Moreover, the country also faced the problem that at periods of natural disaster the supply of food often became tight, and the market price of food volatile. The Bangladeshi government ensured access to food for the poor and tried to stabilize market prices through the Public Food Distribution System. However, it was pointed out that food quality often deteriorated during storage because many food grain storage facilities owned by the Bangladeshi government had become obsolete. Therefore, attention became focused on the construction of a modern warehouse capable of controlling humidity and temperature which would be a technological model for food storage. Santahar in the Bogra district, where the project constructed the warehouse, is in the north-western part of Bangladesh, and its surrounding area is one of the country's most important granary areas.

Japan had supported the construction of food warehouses in Bangladesh for a long period. From 1977 to 1986, grant aid was provided for the construction of food warehouses (total storage capacity: 115,000 tons). In 2009, it was decided that a food warehouse would be constructed with the counterpart fund of the Grant Aid for Debt Relief.

With this background, the Bangladeshi government requested that Japan provide grant aid in 2009 for the construction of a multi-story warehouse capable of humidity and temperature control and the equipment for cargo handling and monitoring.

1.2 Project Outline

The objective of this project is to increase a storage capacity by the construction of rice warehouse in the Bogra district, a granary area located in the north western part of Bangladesh, thereby contributing to a stable food supply and food security nationwide, including in disaster periods.

Grant Limit / Actual Grant Amount	(Detailed Design) 42 million yen / 41million yen (Construction) 2,156 million yen / 1,966 million yen
Exchange of Notes Date / Grant Agreement Date	(Detailed Design) January 2012 / February 2012 (Construction) June 2012 / June 2012
Executing Agency	Directorate General of Food, Ministry of Food[1]
Project Completion	June 2016
Target Area	Santahar, Bogra District
Main Contractors	(Construction) Shimizu Corporation (Equipment) Sirius Corporation
Main Consultant	Kokusai Kogyo Co., Ltd.
Preparatory Survey	October 2010 – January 2012
Related Projects	None

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

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

Duration of the Study: November 2019 – December 2020

Duration of the Field Study: January 4, 2020 – January 13, 2020

2.3 Constraints during the Evaluation Study

At the planning phase, the planned impact of this project was defined as "a stable food supply and food security nationwide, including in disaster periods" and indicators (food assistance for poor households and food assistance for people affected by natural disasters) to measure this impact were set. However, the amount of actual shipping from the project warehouse by public food assistance programs could not be obtained. The achievement levels of the indicators were estimated by using the shipping amount, the storage amount, and the storage capacity at the ex-post evaluation. For this reason, the indicators for the impact were not based on actual figures.

[1] At the ex-post evaluation. The name of the executing agency was the Directorate General of Food, Ministry of Food and Disaster Management at the ex-ante evaluation.

3. Results of the Evaluation (Overall Rating: B[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Bangladesh

At the planning phase of this project, the National Development Plan *National Strategy for Accelerated Poverty Reduction II (Revised) FY2009-11* (2009) had five strategic blocks, of which "Strategy Block IV: Social Protection for the Vulnerable" mentioned food security. The plan stipulated that the government would prepare an adequate amount of food stock and strengthen food grain storage capacity. In the sector plan *National Food Policy 2006* (2006), one of the major policies was fair intervention in the food grain market for price stabilization. The government had the policy of controlling the food grain price by increasing or decreasing government storage in the case of significant price change. For this policy, the government set the goal of building food grain warehouses with a capacity of 1 million tons. Moreover, *the National Food Policy Plan of Action 2008-2015* (2008) had the policy of modernizing government storage facilities for the improvement of food stock management.

At the ex-post evaluation, the national development plan, *the Seventh Five Year Plan FY2016-FY2020* (2015) stated that food security was to follow the goals, priority areas, and actions set in the aforementioned sector plans (*National Food Policy 2006* and *National Food Policy Plan of Action 2008-2015*). In addition, the plan mentioned that government stock was one of the policy tools to support food producers and consumers, and that the government would maintain the public storage facilities with an adequate capacity. According to officers of the executing agency, the Directorate General of Food (DGF), no succeeding plans were formulated either for *the National Food Policy 2006* or *the National Food Policy Plan of Action 2008-2015*[4] and, therefore, both plans were also referred to at the time of the ex-post evaluation.

At the planning phase and the ex-post evaluation, the Bangladeshi government had emphasized the policy of enhancing and maintaining food grain storage facilities for food security in its national development plans. The same sector plans were referred to at both the pre- and the post-project period. The plans focused on the stabilization of food grain prices through the adjustment of government stock and an increase in food storage facilities was planned as a tool to implement the policy. This project increased the public food storage capacity and contributed to the stable supply of food grain. Therefore, the project was consistent with food security and price stabilization of food grain, both of which were emphasized in the national development plans and the sector plans.

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

[3] ③: High, ②: Fair, ①: Low

[4] According to DGF officers, *the 8th Five-Year Plan,* which was being formulated at the ex-post evaluation, mentioned the development of food storage facilities.

3.1.2 Consistency with the Development Needs of Bangladesh

At the planning phase, the Bangladesh government procured rice (mainly domestic rice) and wheat through the Public Food Distribution System (PFDS) and provided food assistance mainly to poor households. The main purposes of PFDS include (1) food supply to poor households who suffer from shortage of food, (2) food supply during emergencies such as natural disasters, (3) stabilization of food prices to increase domestic production, and (4) food grain supply toward prevention of price surges. Nevertheless, domestic food stocks were exhausted when domestic agricultural production declined due to the large cyclone Sidr in 2007. It was evident that storage capacity was insufficient. Moreover, grain prices increased worldwide in 2007 and 2008 and, in particular, the price of rice rose significantly due to the export bans of major exporting countries. The increase in food prices had a serious impact on the livelihoods of the poor and caused political and social unrest in several developing countries including Bangladesh. Bangladesh produced 32 million tons of rice in FY2009-10[5] but the Ministry of Food and Disaster Management had the storage facilities for only 1.54 million tons[6] in March 2010. The government was expected to require storage facilities with a capacity of 3 million tons in 2015. Furthermore, many existing food grain warehouses were one-story simple warehouses without sufficient control of temperature, humidity, and pests, and therefore damage to food grain stock occurred due to deterioration and the decay of grain.

At the ex-post evaluation, PFDS was increasing the supply of rice. While a total of 1.30 million tons were supplied in FY2009-10 (Paid: 0.49 million tons, Grant: 0.82 million tons), a total of 2.07 million tons were supplied in FY2018-19 (Paid: 0.97 million tons, Grant: 1.10 million tons). The main purposes of PFDS remained unchanged at the ex-post evaluation. The Bangladeshi government's food grain warehouses (rice and wheat) had the capacity of 2.12 million tons (1.83 million tons for rice) in December 2019, but the government planned to expand its capacity to 2.70 million tons (2.4 million tons for rice) by December 2021. Many of the existing storage facilities were old and 45% of the large-scale storage facilities, such as Central Storage Depot (CSD), were over 40 years old.[7] Due to deterioration, CSD could not use 14% of its storage capacity.

Rice supply through PFDS increased in the period from the ex-ante evaluation to the ex-post evaluation, and the storage capacity of rice was necessary for the operation of PFDS. PFDS used the warehouse constructed by this project. At the ex-post evaluation, the existing facilities were aging but the Bangladeshi government was increasing the amount of the rice supply through PFDS. This showed a strong demand for the enhancement of storage capacity by the construction of warehouses.

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[5] Bangladesh Bureau of Statistics (2014) "Yearbook of Agricultural Statistics- 2012"
[6] JICA (2012) "People's Republic of Bangladesh: Preparatory Survey Report for the Improvement of the Capacity of Public Food Storage"
[7] International Food Policy Research Institute (2019) "Public food grain storage facilities in Bangladesh"

3.1.3 Consistency with Japan's ODA Policy

At the planning phase, *the Country Assistance Program for Bangladesh* (2007), promulgated by the Ministry of Foreign Affairs, set "economic growth" as a priority area and focused on infrastructure development in rural areas for poverty reduction. Moreover, the plan emphasized disaster management in the program objective "Social Development and Human Security" and had the policy of supporting disaster mitigation and the improvement of emergency measures in a natural disaster. Following the aid policy, in 2009 the Debt Relief Grand Assistance Counterpart Fund (DRGA-CF) was used to build warehouses with a capacity of 0.11 million tons in the northern region, and the Japan Debt Cancellation Fund (JDCF) was used to construct a wheat silo with a capacity of 0.05 million tons in the south-western part of the country (Mongla port).

The long-term goal of this project was to ensure a stable supply of food grain, including in disaster periods, and food security. The implementation of the project has contributed to infrastructure development in rural areas for poverty reduction and the enhancement of disaster management, both of which were emphasized by the *Country Assistance Program* of the Ministry of Foreign Affairs. Japan also supported the construction of food grain warehouses with other assistance schemes. Thus, this project was consistent with the preceding aid policies and assistance with the emphasis on food security.

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

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

This project constructed a multi-story warehouse for rice (16 storage chambers in total) in Santahar, Bogra District, with Japanese assistance, and also provided equipment for cargo handling equipment and monitoring. In project implementation, consulting services were provided for detailed design, construction and procurement management, and technical assistance. The Bangladeshi government carried out ancillary works for the warehouse (such as the construction of auxiliary facilities, rail tracks, etc.). The scope of this project is shown in the table below.

Table 1: The Scope of this Project (Plan and Actual)

Plan	Actual
a) Construction and Procurement of Equipment ・ Multistory rice warehouse: maximum capacity 25,740 tons, including air conditioning equipment ・ Cargo handling equipment: 4 forklifts and 26,000 palettes ・ Monitoring equipment: 4 moisture meters, 4 grain thermometers, and 4 thermo-hygrometers b) Consulting service ・ Detailed design, construction and procurement management, capacity building program (Technical assistance for maintenance of air conditioning equipment, loading, moving, and storage of rice bags using pallets, and warehouse operation/inventory management)	a) Construction and Procurement of Equipment ・ Multistory rice warehouse: maximum capacity 25,740 tons, including air conditioning equipment and solar power system ・ Cargo handling equipment: Same as left ・ Monitoring equipment: Same as left b) Consulting service ・ Same as left

Source: documents provided by JICA, the preparatory survey report

The scope of this project was almost as planned for both the Japanese side and the Bangladeshi side. The major change in the project scope was the addition of a solar power system to the warehouse. Since blackouts have occurred frequently in Bangladesh, the system had the advantage of the operation of air conditioning equipment during blackouts in daytime, and was expected to contribute to a reduction in electricity costs.

Inside the storage chamber

Air-conditioners

Forklifts

Moisture meters

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost incurred by the Japanese side was adjusted for evaluation purposes taking into consideration the addition of the solar power generation system to the project scope. Some of the cost items financed by the Bangladeshi side were not available and, for this reason, the planned cost was adjusted for accurate comparison. The planned and the actual project costs were compared reflecting these adjustments.

Concerning the total project cost, the planned amount after adjustment was JPY 2,467 million (Japanese side: JPY 2,398 million, Bangladeshi side: JPY 69 million), while the actual costs were JPY 2,383 million (Japanese side: JPY 2,007 million, Bangladeshi side: JPY 376 million), which was within the plan (97% of the plan).

Concerning the project cost for the Japanese side, the actual amount was JPY 2,007 million (84% of the plan) while the planned amount after adjustment was JPY 2,398 million.[8] According to the construction supervision consultant, the contractor who won the tender for the warehouse had conducted construction works in Bangladesh and was an established business foundation. For this reason, the company could conduct construction works efficiently and its bid price fell below the price estimation. On the other hand, for solar panels, bidding prices exceeded the price estimation, and the tender was re-issued twice. There were three reasons for the price hike for solar panels: (1) the price of solar panels soared due to the worldwide boom in solar power generation, (2) transportation costs in Bangladesh increased due to political unrest, and (3) it was necessary to respect the quality of procured equipment.

Concerning the project cost for the Bangladeshi side, the planned amount after adjustment was JPY 69 million[9] and the actual amount was JPY 376 million (545% of the plan).[10] Construction costs of facilities such as office buildings adjacent to the warehouse and railways to transport rice exceeded the planned amount.

3.2.2.2 Project Period

Since the solar power system had been added to the project scope, the planned and actual months for the project period were compared reflecting the change. Moreover, construction was delayed due to political unrest occurring in the project period. Therefore, judgement was made taking delays caused by political unrest into consideration.

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[8] At the planning phase, the planned amount for the Japanese side was JPY 2,198 million. Due to the expansion of the project scope, solar panels (181 million yen) and the foundation for solar power generation system (19 million yen) were added to the planned amount.

[9] At the planning phase, the planned amount for the Bangladeshi side was 614 million yen. As the actual costs for tariffs, VAT, and various fees could not be obtained, the total amount for these expenses (545 million yen) was subtracted from the planned amount.

[10] Calculated with the average rate of IFS for the project implementation period.

The project period was from the commencement of the detailed design in March 2012 to the completion of the solar power system in June 2016 (4 years and 4 months, 52 months). The project period was originally planned to be 2 years and 9 months (33 months). Since the solar power system was installed on the rooftop of the warehouse, 18 months, the period from the completion of the warehouse (December 2014) to the completion of the solar power system (June 2016), was added to the planned period. In addition, traffic was cut off by Hartal[11] during the project period. A delay in construction work of approximately one month occurred due to this force majeure which could not be attributed to the contractor. Compared with the planned period (4 years and 4 months, 52 months), the actual period was 100% of the plan, which was as planned.

Both the project cost and project period were within the plan. Therefore, efficiency of the project is high.

3.3 Effectiveness and Impacts[12] (Rating: ②)

3.3.1 Effectiveness

As the effectiveness of this project was defined as "an increase in storage capacity", and the indicators "Storage of rice," "Inventory turnover" and "Frequency of pest control" were selected for the measurement of project effect. Judgment was made based on these indicators. Since this project installed air conditioning equipment, the temperature and humidity inside the chambers for rice storage were additionally analyzed. As mentioned above, a solar power system was also added to the project scope and, therefore, its effectiveness was also assessed.

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

(1) Storage amount of rice

The maximum capacity of the warehouse constructed by this project was 25,740 tons. However, the appropriate capacity was 19,512 tons under normal operations as the maximum capacity included the use of spaces which were difficult to move in and out of efficiently. The actual storage amount of rice was 14,445 tons at the end of 2019 which was approximately 70% of the target. Immediately after the warehouse started operation, it was difficult to pile up stacks to the height assumed at the planning phase. At the time, it had been planned that a 50kg bag would be used but the upper side of the bag was not flat. In addition, as broken bags were often repaired and reused in Bangladesh, the uneven shape of the bags made it even more difficult to pile them up to the height initially planned. After 2019, however, a 30kg bag was

[11] Political protests in Bangladesh. As participants blocked roads and prevented the operation of public transportation, materials and personnel could not be moved. Thus, project implementation was delayed.

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

introduced and this made it easier to pile up stacks. The improvement of stacking resulted in a significant increase of storage.

Table 2: Storage Amount of Rice

	Baseline	Target	Actual*			
	2011	2017	2016	2017	2018	2019
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	2 Years After Completion
Storage amount (ton)	-	19,512	-	0	5,622	14,445

Source: documents provided by JICA and DGF
Note: * The actual amounts were the storage at the end of December for each year.

(2) Inventory turnover

An inventory turnover was planned once per year. The actual inventory turnover rate was 0.87 times/year in 2019 and almost reached the target. Out of the three harvest seasons for rice in Bangladesh, the rice for two seasons was being stored at the ex-post evaluation. According to DGF officers, the stocked rice was shipped within about one year. The warehouse was operated under the principle that long-term storage exceeding one year was not allowed.

Table 3: Inventory Turnover

	Baseline	Target	Actual			
	2011	2017	2016	2017	2018	2019
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	2 Years After Completion
Inventory turnover* (times / year)	-	1.00	-	2.38	0.22	0.87

Source: documents provided by JICA and DGF
Note: * Inventory turnover = Shipment amount from the warehouse ÷ Inventory amount (monthly average)

(3) Frequency of pest control per storage chamber

The frequency of pest control per storage chamber was used as an indicator for the quality of stocked rice and a comparison was made with another rice warehouse in the vicinity (Santahar CSD[13]). Two types of pest control, spraying and fumigation, were used. Fumigation is more effective than spraying but spraying is easier to carry out. In the project warehouse, fumigation took place less frequently than in the existing warehouse, while spraying was more frequent. Therefore, the impact of this project on the frequency of pest control was moderate. In the warehouse constructed by this project, storage chamber No.1 was sprayed 11 times and

[13] To specifically show the effect on rice quality of the air conditioning equipment installed by this project, Santahar CSD was chosen because the depot consists of conventional flat warehouses in the same climate as the warehouse funded by this project.

fumigated 5 times. Pest outbreaks occurred more easily in the storage chamber because rainwater occasionally leaked into the chamber during the rainy season.

Table 4: Frequency of Pest Control per Storage Chamber

	Baseline	Target*	Actual			
	2011	FY2018-19	FY2015-16	FY2016-17	FY2017-18	FY2018-19
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	2 Years After Completion
Spraying (times / year)	-	3.81	-	-	-	5.53
Fumigation (times / year)	-	2.50	-	-	-	2.33

Source: documents provided by JICA and DGF
Note: * The target is the data from the nearby rice warehouse (Santahar CSD) for 2018-19

(4) Temperature and Humidity

The warehouse constructed by this project stored parboiled rice[14] and used the air conditioning equipment to preserve the rice. According to the construction supervision consultant, the storage chambers should have a temperature below 30°C and a humidity of 65% to 70%. Temperature and humidity were measured at storage chambers No. 3 – No. 16 during the site survey.[15] In the storage chambers, the temperature was from 22.8°C to 25°C and the humidity was from 49% to 56%. Concerning the temperature and humidity control inside the chambers, dryness was a major problem. It tends to be dry inside the warehouse in the winter season as the temperature drops and the rainfall decreases. According to DGF officers, the air conditioners and the dehumidifiers were used during the rainy season.

(5) Power generation by the solar power system

This project installed a solar power system on the rooftop of the warehouse for the reduction of electricity consumption for warehouse operations. According to DGF officers, the Santahar silo, including the project warehouse, was supplying electricity to the power distribution company (NESCO) at the time of the ex-post evaluation. As the amount of electricity supplied to the grid was subtracted from the electricity consumption of the Santahar silo, the electricity charge to the silo was reduced. The solar power system supplied 185,000kWh in 2017-18, 101,000kWh in FY2018-19, and 95,000kWh in FY2019-20 (until April). After the commencement of power generation, the voltage of the power supplied became unstable due to a lightning strike during the rainy season and this damaged the power receiving equipment

[14] Parboiling is a process before milling for the preservation of rice.
[15] 10:00-12:00 on January 8th, 2020. Since the first and second storage chambers were under fumigation, temperature and humidity could not be measured in either chamber.

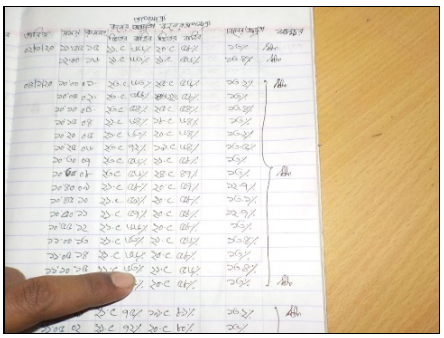
of the power distribution company. For this reason, the power supply was temporarily stopped during the rainy season and, as a result, the amount of power supply dropped after FY2018-19.

3.3.1.2 Qualitative Effects (Other Effects)

(1) Technology transfer of the operation and maintenance in modern warehouse

Through the technical assistance of the soft component, warehouse staff learned the techniques of piling up and rotating stacks by forklifts and pallets, inventory management (such as the First-In First-Out method), and monitoring (moisture content, grain temperature, temperature and humidity). Intra-house rotation is a technique used when rice with a long storage period is shipped. The method is an essential technique for the First-In First-Out method for rice bags in warehouse operation and enables a longer storage of rice. Moreover, there was instruction on the use of checklists for stacking according to the manuals, the use of templates for the records of temperature/humidity control, temperature/humidity/grain temperature/grain moisture content, and an inspection record for air conditioners and dehumidifiers.

At the time of the ex-post evaluation, acceptance inspections of rice and bags, the labelling of stacks, and stacking were conducted mostly in line with the manuals. However, since the stocked rice was shipped within one year, it is not operated First-In First-Out by intra-house rotation. The temperature and humidity inside and outside the storage chambers, the grain temperature of rice, and the grain moisture content were also measured and recorded daily in accordance with the manuals.



The note recording monitoring data

(2) Quality of stocked rice

As mentioned above, pest control by fumigation at the project warehouse was carried out less frequently than at the existing warehouses because of the air conditioning equipment. Warehouse staff commented that fumigation tend to turn the rice yellow and, thus, the rice at the project warehouse was less discolored than at other warehouses. On the other hand, the weight loss of stocked rice sometimes exceeded the DGF regulations, though this did not lead to the disposal of rice. The weight loss of rice was 0.24% to 2.08% in FY2018-19 and exceeded the DGF regulations (0.5%s for a storage period of 6 months, 0.75% for 9 months, 1.0% for 12 months) in some shipments. At the time of the ex-post evaluation, DGF had taken measures to decrease weight loss by less use of air conditioners and setting the temperature higher. As a result, the weight loss of rice decreased in FY2019-20.

Table 5: Weight Loss of Stock Rice

Fiscal Year	Shipment (ton)	Weight loss (ton)	Weight loss (%)	Min. - Max.
2016-17	404.970	0.000	0	–
2017-18	600.30	4.00	0.66%	0.50% - 0.75%
2018-19	7,480.96	61.50	0.82%	0.24% - 2.08%
2019-20	14,357.82	109.10	0.76%	0.04% - 1.04%

Source: documents provided by DGF

3.3.2 Impacts

3.3.2.1 Intended Impacts

The impact of this project was assumed to be "a stable food supply and food security nationwide, including in disaster periods." Of the quantitative indicators set at the planning phase, the achievement level of the indicators to measure the impact (Food assistance for poor households and people affected by natural disasters) are analyzed. In addition, analysis was made of the qualitative effects showing impacts expected at the planning phase (such as enhancement of the capacity for emergency food distribution during disasters, the stability of food prices and domestic distribution).

(1) Food assistance for poor households and people affected by natural disasters

DGF did not collect the shipping data for each food assistance program by warehouse and were unable to find out the final use of the rice shipped from this warehouse. Therefore, the targets for the food assistance for poor households and people affected by natural disasters are calculated based on the normal storage of the project. The scales of benefits are estimated by using the shipment amount, the storage amount, and the storage capacity at the ex-post evaluation.

As shown in Table 6, while the target for the storage amount was assumed to be 19,512 tons at the planning phase, the shipment amount was 8,271.82 tons in 2019 and the storage amount was 14,445.44 tons at the end of 2019. According to DGF officers, the storage capacity under normal conditions was estimated to be 17,153 tons when using only 30 kg bags with stacking skills as they were at the ex-post evaluation. At the planning phase, food assistance for poor households was assumed to be 30kg per month for each household, while food assistance for people affected by natural disasters was 10kg per person. This analysis uses these assumptions.

Since the shipment volume was still insignificant in 2019, the actual benefits of the food assistance for poor households and the victims of natural disasters are presumed to be smaller than the targets (see Table 6). Nevertheless, the number of beneficiaries is expected to increase in 2020 as the storage amount increased at the end of 2019. Given the storage capacity, there is room for a further increase in the number of beneficiaries.

Table 6: Food Assistance for Poor Households and People Affected by Natural Disasters (Estimation)

	Storage (Target)	Shipment (2019)	Storage (at the end of 2019)	Storage capacity (2020)
Tonnage	19,512.00	8,271.82	14,445.44	17,153.00
Food assistance for poor households* (Number of beneficiary households)	650,400	275,727	481,515	571,767
Food assistance for people affected by natural disasters (Number of beneficiaries)	1,951,200	827,182	1,444,544	1,715,300

Source: calculated by the external evaluator based on the documents provided by DGF.
Note:* The number of beneficiary households = Storage (Target) / Shipment (2019) / Storage (at the end of 2019) / Storage capacity (2020) ÷ Food assistance per poor household (30kg/month)
Note:** The number of beneficiaries = Storage (Target) / Shipment (2019) / Storage (at the end of 2019) / Storage capacity (2020) ÷ Food assistance per person affected by natural disasters (10kg/person)

(2) Destination of rice shipment

As explained above, it was difficult to ascertain the use of shipped rice. Therefore, it was also difficult to obtain data to directly show the expected qualitative effects. Nevertheless, there was a wide area of destinations for rice shipment from the project warehouse, and it can be assumed that the project contributed to a stable supply of food grain throughout the country.

Figure 1: Destinations of shipments from the warehouse

Out of 64 districts in Bangladesh, the project warehouse shipped rice to 22 Local Storage Depots (LSD) in 11 districts. The 11 districts covered a wide area of the northwest (Bogra, Sirajganj), the southwest (Shatkhira), the central area (Sherpur, Gazipur, Faridpur, Gopalganj, Shariatpur), the northeast (Sylhet), and the southeast (Chandpur, Lakshmipur). The districts to which the project warehouse shipped rice were scattered all over Bangladesh, and the project was expected to help reduce excesses and shortages of rice among regions.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the natural environment

At the planning phase, this project was classified as Category C (a project likely to have minimal or little adverse impact on the environment and society) in accordance with the *Japan*

International Cooperation Agency: Guidelines for Environmental and Social Considerations (2010). According to the construction supervision consultants and questionnaire answers from DGF, the implementation of this project did not require an environmental impact assessment because the facilities constructed by the project were to be built on the site of an existing wheat silo. Based on questionnaire answers from DGF and interviews, no environmental monitoring was conducted during project implementation or after project completion. No serious negative impact on the natural environment was found during project implementation or after project completion.

(2) Resettlement and land acquisition

As mentioned above, the warehouse constructed by this project was built on the site of an existing silo. A part of the land for the office building, an auxiliary facility of the warehouse, was purchased from Bangladesh National Railways but the land acquisition did not require resettlement. At the planning phase, it had been expected that residents would be relocated due to the construction of the railway to the warehouse. The railway to the warehouse was constructed but the track alignment was changed. The tracks were built on the existing site, and thus the implementation of the project did not cause resettlement.

(3) Effects from displaying warehouse facilities

This project supported the construction of the first multi-story warehouse capable of humidity and temperature control in Bangladesh. Senior officials from the Ministry of Food and DGF frequently visited the warehouse constructed by the project to observe the modern warehouse facility and its operations. From the end of 2014 (the completion of the warehouse building) to May 2020 (the ex-post evaluation), senior officials from the Ministry of Food and DGF visited the warehouse 13 times, and a total of 17 people were able to deepen their knowledge of the modern warehouse facility and its operation. These senior officials included not only DGF managers of warehouses management but also policymakers for national food policy such as the Minister and the Vice-Minister of the Ministry of Food and the Director General of DGF.

(4) Response to COVID-19

As a response to COVID-19, the project warehouse shipped approximately 14,000 tons of rice to Dhaka from March 2020 to May 2020. The shipped rice was used for the food assistance program for poor households (Vulnerable Group Development) or sold in the open market for market stabilization. In consideration of the COVID-19 pandemic, the Bangladeshi government increased the storage of food grain for disaster relief and adopted the policy of effectively using the warehouse during the off-season. After May 2020, the warehouse was also storing wheat in the period from rice shipment to stockpiling.

This project has achieved its objectives to some extent. Therefore, effectiveness and impacts of the project are fair.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

At the ex-post evaluation, the DGF Santahar Silo was responsible for the operation and maintenance of the warehouse constructed by this project. The Santahar Silo was also in charge of the operation and maintenance of the adjacent wheat silo, which was in operation before the implementation of this project. Concerning the division of roles in operation and maintenance, the Santahar Silo carried out the daily tasks of operation and maintenance and prepared a maintenance plan and a budget plan, while the DGF Headquarters reviewed and approved the maintenance plan and the budget plan. The DGF Headquarters also conducted assessment on the necessity of maintenance work and staffing of the silo. The movement of rice were in accordance with the instructions from the DGF Headquarters, the Regional Controller of Food, and the District Controller of Food.

While the number of staff in the Santahar Silo was 88 (including 3 engineers) in 2016, the number of staff in the silo was 75 (including 2 engineers) in 2019. The number of staff decreased in the three years. According to DGF officers, the movement of rice in the warehouse was not as frequent as in other warehouses. The silo could therefore cope with the reduction of personnel with labor-saving thanks to cargo handling equipment and overtime work by silo staff. Although staffing was slightly tight, no serious effect was seen in the operation of the warehouse.

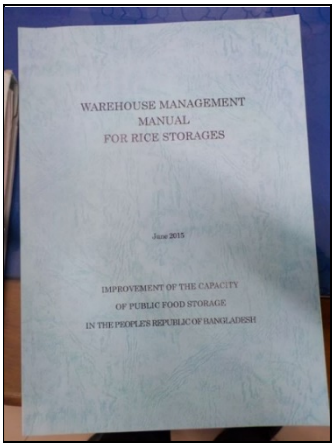
At the ex-post evaluation, the responsibilities for the operation and maintenance under the project were clearly defined. Although the number of staff decreased at the Santahar Silo, the silo did not face any serious obstacles in its operation and maintenance. Therefore, it was concluded that there was no problem affecting the sustainability of project effects in terms of the institutional/organizational aspect.

3.4.2 Technical Aspect of Operation and Maintenance

Since this project constructed the first multi-story warehouse with air conditioning equipment in Bangladesh, it implemented the soft component simultaneously and conducted training on the use and maintenance of the equipment provided (air conditioning equipment, cargo handling equipment, and monitoring equipment). However, as aforementioned in “3.3.1.1 Quantitative Effects”, it was difficult to pile a stack to the height assumed at the planning phase due to the shape of rice bags. At the ex-post evaluation, skills had been maintained through use of the equipment. The soft component also included the instruction of warehouse operation based on First-in First-out of rice bags by intra-house rotation so that rice with a long storage period could

be shipped first. At the ex-post evaluation, however, intra-house rotation was not being conducted.

Various manuals (warehouse management, cargo handling equipment, air conditioning equipment) in both English and Bengali were also prepared as part of the soft component. At the ex-post evaluation, the manuals were kept in the office of Santahar Silo, but the warehouse staff did not routinely refer to them during operation. Nevertheless, operation and maintenance was implemented almost in line with the manual. Based on interviews with DGF officers, it was confirmed that the use of checklists, recording formats and the manuals had begun in the first half of 2020.



Warehouse management manual

According to DGF officers, there was almost no training opportunity for warehouse management or the operation and maintenance of air conditioning equipment and cargo handling equipment after project completion. The DGF staff officer conducted a training session once only for 2 days. At the ex-post evaluation, a regular training program for warehouse management and the operation and maintenance of air conditioning equipment and cargo handling equipment was not planned.

Although the soft component of this project improved capacity, and the operation and maintenance were in line with the manuals to some extent, it took a longer period to introduce the checklist and various recording formats. As there were very few training opportunities on warehouse management and the provided equipment in DGF, it was difficult to provide systematic training to newly assigned staff. Therefore, it was concluded that there were some minor problems in the technology aspect which affect the sustainability of project effects.

3.4.3 Financial Aspect of Operation and Maintenance

The budget of DGF is divided into the purchasing budget and the organizational budget. The operation and maintenance of the project warehouse was financed with the organizational budget (a budget required for organizational operations such as salary, consumables, and maintenance works). At the planning phase, the annual operation and maintenance cost of the warehouse was estimated to be BDT 11.6 million.[16] After the project started, however, a solar power system was added to the project scope of the project and at the ex-post evaluation, warehouse operation had not increased electricity charges.[17] According to DGF officers, the solar power system on the rooftop of the warehouse supplied electricity to the grid and the electricity charge to the

[16] The maintenance costs for the building and the equipment, both of which had not occurred by the time of the ex-post evaluation, were subtracted from the annual operation and maintenance expense estimated at the planning phase.
[17] Before the operation of the warehouse, the electricity charge of the Santahar Silo was BDT 2.8 million in FY2015-16. As at the ex-post evaluation the electricity charge was BDT 2.7 million in FY2018-19, the charge had not increased.

Santahar Silo was thus partially offset. For this reason, the required expenditure was estimated to be 6.4 million BDT annually if the electricity charge was removed from the estimated expenses for operation and maintenance (see Table 7).

Table 7: The Estimated Cost for the Operation and Maintenance of the Warehouse

Unit: thousand BDT

Items	Cost/Year
Salary (full-time staff)	2,700
Salary (part-time staff)	800
Repainting of floor signs	400
Telecommunication	90
Postal fees	40
Office supplies	70
Others	2,300
Total	6,400

Source: recalculated by the external evaluator based on data of the preparatory survey.

The organizational budget of DGF had increased at the ex-post evaluation. The organizational budget (expenditure basis) increased from BDT 3,080 million in FY2015-16 to BDT 4,720 million in FY2018-19, 1.5 times in four years. During this period, as shown in the table below, the organizational budget (expenditure basis) of the Santahar Silo also increased. Compared with the organizational budget of the year previous to the commencement of warehouse operation (FY2015-16: BDT 35.1 million), that of the years after warehouse operation began (FY2016-17 to FY2018-19: BDT 40.7 million on average) increased by BDT 5.6 million. The increase did not reach the estimated increase in annual maintenance expenditure (6.4 million BDT) associated with the operation of the warehouse. As mentioned above, it is difficult to provide training on operation and maintenance due to the shortage in the operation and maintenance budget.

Table 8: The Organizational Budget of the Santahar Silo

Unit: BDT

	FY2015 - 16 Expenditure	FY2016 - 17 Expenditure	FY2017 - 18 Expenditure	FY2018 - 19 Expenditure
Salary	26,409,857	16,411,238	30,599,872	31,388,178
Operation and Maintenance	8,671,877	24,565,154	9,465,970	9,798,704
Organizational budget - total	35,081,734	40,976,392	40,065,842	41,186,882

Source: DGF

Although the organizational budgets of DGF and the Santahar Silo increased, the incremental amount of the organizational budget of the Santahar Silo was less than the required amount estimated at the project planning. Therefore, the organizational budget of Santahar Silo might affect the operation and maintenance of the warehouse in a long run. In terms of the financial aspect, it is concluded that there were some minor problems affecting the sustainability of problem effects.

3.4.4 Status of Operation and Maintenance

A site survey was conducted to assess the current status of the warehouse and the equipment provided by the project. The results of the site survey are as follows.

Warehouse: There was no significant damage in the building. All air conditioning equipment (air conditioners and dehumidifiers) were usable and spare parts could be obtained. The air conditioning equipment in operation was maintained (including cleaning) once every two weeks. A dedicated distribution line to the warehouse only was installed. The warehouse had blackouts 2-3 times a year mainly in the rainy season but it recovered in 5 to 20 minutes. According to the DGF officer, at the ex-post evaluation, the solar power system was in a usable condition and maintenance work such as the cleaning of solar panels was performed once a week. Domestic suppliers can obtain and install replacement parts for the solar power system.

Cargo handling equipment: All of the four forklifts were in a usable condition. When in operation, the forklifts were cleaned daily and battery electrolyte was added. Lubricant was applied twice a year. As some parts of the forklifts need to be replaced every four years, purchase of these parts was planned for the future. Spare parts could be obtained from forklift dealers. Pallets were either used in the warehouse or stored in places away from rainfall.

Monitoring equipment: Thermo-hygrometers, moisture meters, and grain thermometers (four for each type of equipment) were stored in the warehouse, and one thermo-hygrometer, one moisture meter, and one grain thermometer were used daily. One of the moisture meters was out of order but it was not repaired because other meters could be used. According to DGF officers, suppliers could be contacted for spare parts and repair services. As a calibration service was not used, the accuracy of the thermo-hygrometers and the moisture meters were assessed by comparison with newly purchased equipment.

The site survey found that although there was slight damage to the warehouse and the provided equipment, they were still in a usable condition and no serious damage which would affect the project effects was discovered. Therefore, in terms of the current status, it was concluded that there was no problem that affected the sustainability of project effects.

Some minor problems have been observed in terms of the technical aspect and the financial. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to increase storage capacity by the construction of a rice warehouse in the Bogra district, a granary area located in the north-western part of Bangladesh, thereby contributing to a stable food supply and food security nationwide, including in disaster periods. At the planning phase and at the ex-post evaluation, it was the policy of the Bangladeshi

government to enhance and maintain food grain storage facilities. At the ex-post evaluation, the existing facilities needed to be rebuilt while the Bangladeshi government was increasing the amount of rice supply through its food programs. The scope of this project was also consistent with the aid policies of Japan. Therefore, its relevance is high. A solar power system was added to the scope of the project. Taking into consideration the additional project scope, the project cost was within the plan and the project period was as planned. Therefore, efficiency of the project is high. Regarding the achievement level of the quantitative indicators, the "Inventory turnover" was mostly achieved, but achievement of "Storage amount of rice" and "Frequency of pest control" were moderate. It was difficult to analyze the impact quantitatively. However, the warehouse shipped rice to a wide area and was also being used to stock wheat at the ex-post evaluation. Thus, effectiveness and impacts of the project are fair. In terms of the institutional/organizational aspect, although staff numbers were slightly tight, this issue did not affect warehouse operations severely. For the technical aspect, periodic training was an issue. For the financial aspect, an increase in the organizational budget did not reach the requirement estimated at the planning phase, though the organizational budget was increasing. In the status of the operation and maintenance, no serious damage to the project effects was found. For the above reasons, sustainability of the project effects is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Revision of the manuals for operation and maintenance

DGF operates the warehouse almost in line with the manuals. However, it took a long time to introduce the use of a checklist and record keeping using specified formats. Since the storage period of rice was relatively short (approximately 1 year), the importance of intra-house rotation of the stacks was weakened. Moreover, wheat was also being stocked at the ex-post evaluation and this was not expected at project completion. The completion report of the soft component also emphasized the necessity to update and modify the manuals to reflect the actual situation, as operational conditions differed between Bangladesh and Japan. It is desirable that inconsistencies between the contents of the manual and current operation are examined and that the manuals are revised immediately.

4.2.2 Recommendations to JICA

Monitoring and technical support

DGF may require technical support when the agency updates and modifies the manuals for operation and maintenance. In tandem with the revision of the manuals, training relevant to the

new operational procedures will also be required. It is desirable that JICA continue to monitor the revision of the manuals by DGF and provide technical assistance when needed by the agency.

4.3 Lessons Learned

Careful assessment on the use of rice bags in other countries

At the planning phase, the storage amount of the warehouse was set with the assumption that 50kg bags would be used. However, the upper side of 50kg bags had a small flat area, and the shape was not uniform due to reuse of the bags. Therefore, it was difficult to stack 50kg bags to the height assumed at the planning phase using the forklifts and the pallets. During the implementation phase, it became clear that the conditions of the bags significantly affected the amount of rice stock, and it took time to resolve this issue. The compatibility between the rice storage using 50kg bags and the use of forklifts was not sufficiently examined because Bangladesh did not stock rice with modern equipment at the planning phase of this project. It would be meaningful to assess the compatibility of the rice storage methods and the use of forklifts in other countries, especially those with similar economic conditions, in order to find issues with the modernization of warehouse management at an earlier phase of the project planning.