Ex-Post Project Evaluation 2020: Package IV-4 (Timor-Leste, Moldova)

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JAPAN INTERNATIONAL COOPERATION AGENCY

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The Democratic Republic of Timor-Leste

FY2020 Ex-Post Evaluation of

Japanese Grant Aid Project

"Project for Rehabilitation and Improvement of Buluto Irrigation Scheme"

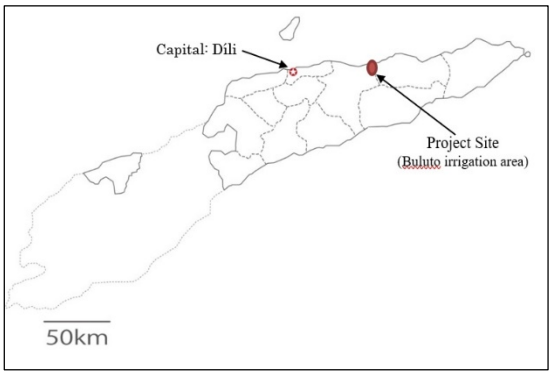
External Evaluator: Kenichi Inazawa, Octavia Japan, Co., Ltd.

0. Summary

This project aimed to increase rice production through stable supply of agricultural water, by constructing modern intake facilities and irrigation canals, etc. in the Buluto irrigation area where traditional irrigation methods had been used, thereby improving the food self-sufficiency rate of Timor-Leste. The *National Priority Program* and the *Ministry of Agriculture and Fisheries Strategic Plan*, formulated by the government of Timor-Leste advocate improving rice productivity and food self-sufficiency, and there is a need to improve agricultural productivity and support farmers' livelihoods in rural areas nationwide, including the Buluto irrigation area. As it is also consistent with Japan's ODA policy, relevance of this project is high. With regard to efficiency, the outputs were almost as planned, and the project cost was within the plan. However, the project period slightly exceeded the plan, mainly because it took time to acquire land around the project site and to process tax exemptions when clearing materials and equipment through customs; thus, efficiency is fair. Regarding effectiveness/quantitative effect indicators, 1) the yield of rice exceeded the target. While the actual 2) planted area and 3) irrigable area exceeded the targets in the rainy season, they did not reach the targets in the dry season. The total values for the rainy and dry seasons combined, were generally close to the targets. In addition, it was confirmed through interviews that this project contributed to the motivation of farmers to produce rice, an increase in production and a reduction in labor required for the maintenance of irrigation canals. Furthermore, synergistic effects with JICA's technical cooperation project, aimed at improving rice productivity and farmers' livelihoods can be expected in the future. Therefore, the effectiveness/impact is high. As for sustainability, there are no particular concerns regarding the institutional/organizational or technical aspects of the executing agency of this project, Direção Nacional de Irrigação e Gestão da Utilização de Água (hereinafter referred to as "DINIGUA") or the water users' association. While there are no particular problems with the operation and maintenance status of the developed irrigation facilities, a budget has not been allocated in recent years for the regular repairs, repairs relating to damages or large-scale repairs of intake weirs, intake gates, sand basins and waterways, which needs to be addressed. Therefore, the sustainability of the effects generated by this project is fair.

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

1. Project Description



Project location

Irrigation facility developed by this project

1.1 Background

Prior to the start of this project, Timor-Leste's agriculture was characterized by extensive farming and low rice productivity. In order to realize food security and economic development in the country, it was necessary to expand rice production. The Buluto irrigation area, which is the target area of this project, is located on the national highway connecting the capital, Dili and the second city, Baucau[1], and had potential in terms of access to markets, namely, the sales channels. It was also one of nine priority irrigation districts identified by the government in association with measures to expand rice production; in addition the farmers' motivation for production was higher in this area than in the other irrigation districts. However, the area where rice could be cultivated was limited, due to the unstable water intake, caused by traditional irrigation methods. Therefore, there were expectations that rice productivity would be improved by developing and renovating the irrigation facilities in this area.

1.2 Project Outline

The objective of this project is to increase rice production through stable supply of agricultural water by constructing modern water intake facilities and irrigation canals, etc. in the Buluto irrigation area where traditional irrigation methods had been used, thereby contributing to the improvement in the food self-sufficiency rate of Timor-Leste.

[1] The Buluto irrigation area is approximately 80 km from the capital, Dili.

Grant Limit / Actual Grant Amount		1,499 million / 1,385 million
Exchange of Notes Date / Grant Agreement Date		December 2013 / December 2013 (initial), December 2015 (revised[2])
Executing Agency(ies)		Direção Nacional de Irrigação e Gestão da Utilização de Água (DINIGUA), Ministry of Agriculture and Fisheries
Project Completion		January 2017
Target Area		Buluto irrigation area, Manatuto and Baucau Districts
	Main Contractor	Hazama Ando Corporation
	Main Consultant	NTC International Co., Ltd
	Procurement Agency	None
Basic Design		October 2012–October 2013
Related Projects		- "Irrigation and Rice Cultivation Project in Manatuto" (FY2005–FY2009) - "Irrigation and Rice Cultivation Project in Manatuto Phase 2" (FY2010–FY2014) - "Project for Increasing Farmers Households' Income through Strengthening Domestic Rice Production in Timor-Leste[3]" (FY2016–FY2023)

2. Outline of the Evaluation Study

2.1 External Evaluator

Kenichi Inazawa, Octavia Japan, Co., Ltd.

2.2 Duration of Evaluation Study

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

Duration of the Study: December 2020–December 2021

Duration of the Field Study: No international trips were made. It was conducted remotely with a field survey assistant.

[2] It will be discussed later in "3.2.2.2 Project Period" under efficiency.

[3] The project's objective is to improve each process (production, processing, distribution, sales/consumption) of the rice value chain and increase farmer households' rice sales income. In the future, it aims to improve livelihoods of farmer households in irrigation districts nationwide, including the Buluto irrigation area. The project activities include dispatching of Japanese experts, accepting trainees from Timor-Leste, providing agricultural machinery, repairing warehouse, and providing equipment for irrigation facility repairs

2.3 Constraints during the Evaluation Study

(Conducting a Remote Field Survey with a Field Survey Assistant)

Due to the spread of COVID-19, the external evaluator did not travel internationally. With the field survey assistant, the external evaluator carried out the site visits, collected information and data and conducted interviews with the relevant individuals remotely. The external evaluator analyzed the information collated, so as to carry out an evaluation and make judgements. An interview surveys with residents was planned to conduct in the Buluto irrigation area, but due to the spread of infection in Timor-Leste, it was prevented from visiting over a long period due to restrictions on movement. Therefore, alternatively, a survey was conducted by interviewing staff within the DINIGUA Headquarters, the agricultural offices of the Manatuto and Baucau districts and the water users' association in this irrigation area.

3. Results of the Evaluation (Overall Rating: B[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of Timor-Leste

Prior to the start of this project, the government of Timor-Leste formulated the *National Priority Program* in 2008 and listed "food security through improving productivity," as one of the issues to tackle. With the aim of increasing and diversifying food production and increasing farm income, the following was emphasized: (1) improving food security and nutritional status, (2) providing farmers with a means to increase incomes. In 2011, the government formulated the *Strategic Development Plan* (2011–2030), which positioned agriculture as a strategic sector alongside oil and tourism.

At the time of the ex-post evaluation, the aforementioned *Strategic Development Plan* (2011–2030) continues to be effective, and the improvement of agricultural productivity and food self-sufficiency is emphasized. In addition, the Ministry of Agriculture and Fisheries has formulated the *Ministry of Agriculture and Fisheries Strategic Plan* (2014–2020), an agricultural sector development plan, in which domestic rice production is promoted as a priority issue, with the aim of improving food self-sufficiency.

Based on the above, food production and the improvement of the food self-sufficiency rate were considered important before this project began, as well as at the time of the ex-post evaluation. Therefore, this project is consistent with the policy.

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

[5] ③: High, ②: Fair, ①: Low

3.1.2 Consistency with the Development Needs of Timor-Leste

Prior to the start of this project, Timor-Leste's agriculture was characterized by extensive farming and low productivity. In order to realize food security and economic development in the country, it was necessary to expand rice production. The Buluto irrigation area was one of nine priority irrigation areas identified by the government in association with measures to expand rice production. It was close to the national highway connecting the capital, Dili and the second city of Baucau, and had potential in terms of market access or sales channels. The farmers' motivation to produce was also higher than in other irrigation areas, but the area where rice could be cultivated was limited, due to the unstable water intake, caused by traditional irrigation methods. Productivity was as low as 2.0 tons/ha in the rainy season and 1.8 tons/ha in the dry season. Thus, improving productivity was an urgent issue.

At the time of the ex-post evaluation, the government of Timor-Leste is implementing 8 small and medium-sized irrigation programs and 2 larger irrigation programs; the budget for the development and restoration of irrigation facilities is under consideration (as of the first half of 2021). While the Ministry of Agriculture and Fisheries aims to increase the food self-sufficiency rate to 70% by 2023, the food self-sufficiency rate is as low as approximately 20%[6] at the time of the ex-post evaluation. The government is continuing its investment in the agricultural sector, such as the development of irrigation facilities, with the aim of improving rice productivity and the food self-sufficiency rate. However, as will be explained under 3.3.2.1 Intended Impacts (Table 4), the country's rice harvest area and production have not increased steadily over the last six or seven years. According to DINIGUA, farmers have not necessarily generated much cash income from rice production, as it is not highly profitable, which tends to reduce their willingness to farm. DINIGUA suggests that, in order to resolve this situation, there is an urgent need to increase rice productivity by improving farming techniques and the management of irrigation facilities, and to support farmers' livelihoods by increasing the profitability of rice. Therefore, it can be stated that the need to improve agricultural productivity and support farmers' livelihoods in the area remains high at the time of the ex-post evaluation.

Based on the above, emphasis had been placed on investment in the agricultural sector, the improvement of agricultural productivity and supporting farmers' livelihoods before this project began, as well as at the time of the ex-post evaluation. Therefore, it can be said that this project is

[6] The source is DINIGUA (2021 data). According to DINIGUA, this is a preliminary figure for the first half of 2021 (rainy season: January to June) and does not include the second half of the year (dry season: July to October, rainy season: November to December). Although the figure is expected to increase when the latter period is included, it is estimated to be around 30% at most.

consistent with the development needs.

3.1.3 Consistency with Japan's ODA Policy

Prior to the start of this project, Japan focused on the following four areas in its cooperation with Timor-Leste: 1) human resource development, improvement of administrative capacity for democratic governance, 2) development of economic and social infrastructures and improvement of maintenance capabilities, 3) improvement of agricultural productivity and market access, 4) improvement of security and law enforcement capabilities.

Considering that this project was designed to contribute to the improvement in agricultural productivity by developing irrigation facilities in Timor-Leste, it can be said that this project is consistent with the aforementioned "3) improvement of agricultural productivity and market access" and thus with Japan's assistance policy.

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

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Table 1 shows the output plan and the actual results of this project.

Table 1: Output Plan and Actual Results of This Project

At the Time of the Plan (2013)	Actual (2020)
[Planned Inputs from the Japanese Side] 1) Civil work and equipment procurement: intake facilities (fixed weir 200 m, scouring sluice, sand basins, headrace, revetment, dike, gate control room, materials and equipment warehouse), irrigation canals (main canal: 12.3 km, secondary canals: 15.4 km), drainage channel (4.6 km), riverbank protection, water users' association's meeting house, ground leveling for the demonstration farm, etc. 2) Consulting service / soft component: establishment of water users' association, guidance on water management technology, technical guidance on operation and maintenance of the irrigation facilities	[Actual Inputs from the Japanese Side] 1) Civil work and equipment procurement: intake facilities (fixed type weir 200 m, scouring sluice, sand basins, headrace, revetment, dike, gate control room, materials and equipment warehouse), irrigation canals (main canal: 12.015 km, secondary canals: 15.521 km), drainage channel (4.67 km), riverbank protection, water users' association's meeting house, ground leveling for the demonstration farm, etc.: Implemented almost as planned 2) Consulting service / soft component: Implemented almost as planned

[Planned Inputs from the Timor-Leste Side]	[Actual Inputs from the Timor-Leste Side]
1) Securing land for construction 2) Provision of space for construction, provision of leased land free of charge for the construction work 3) Repairing access roads to the construction sites and informing surrounding residents of the use of the existing roads 4) Obtaining permissions to cut down trees and collect sand and stones from the river, and processing the disclaimer on mining rights (royalty) 5) Informing the relevant parties through public briefings and other methods, if the irrigation water supply is interrupted during construction and ensuring there is a consensus 6) Completing the extension of the electricity feeding cable to the site management office, prior to the initiation of the construction work 7) Obtaining construction permits from the relevant agencies	Implemented almost as planned

Source: Documents provided by JICA, answers to the questionnaire

In this project the outputs were implemented mostly as planned[7]. The differences between the plan and the actual outputs are as follows. With respect to the outputs from the Japanese side, 1) construction-wise, the location of the main canal was changed after construction started, based on the request of a landowner. As a result, the length of the canal was reduced (by approximately 300 m). The length of the secondary canals increased, due to a location change following negotiations and an adjustment with a land provider after the start of the construction (approximately 100 m increase). A meeting house for the water users' association was originally planned to be constructed in the Laleia area, located within the Buluto irrigation area. However, one landowner refused to provide his land, which affected the site of the meeting house and an associated access road[8]. The actual outputs by Timor-Leste were also implemented mostly as planned.

[7] As supplementary information, JICA repaired revetment retaining walls, installed floor protection works and repaired waterways, etc. at the time of ex-post evaluation, as a follow-up to this project.

[8] Instead, the meeting house was constructed in Vemasse area. The situation related to land acquisition will be explained under 2) Resettlement and Land Acquisition in 3.3.2.2 Other Positive and Negative Impacts.

Photo 1: Irrigation facility developed by this project (Main canal) (1)

Photo 2: Irrigation facility developed by this project (Main canal) (2)

Photo 3: Irrigation facility developed by this project (Weir)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was planned to be 1,788 million yen (of which 1,499 million yen was intended to come from the Japanese side and approximately 289 million yen from the Timor-Leste side). Although the total amount spent on the project is unknown, as details on the actual amount

contributed by the Timor-Leste side were not recorded, the Japanese side's actual contribution was approximately 1,385 million yen. As discussed above, the planned outputs of the Timor-Leste side were mostly implemented as per the initial plan, and the planned amount (approximately 289 million yen) was approximately 16% of the total project cost, which is insignificant. Thus, it was assumed that the missing data would not affect the comparison of the planned and actual project costs, and hence, the project cost efficiency analysis was made, based on the comparison of the planned and actual amounts of the Japanese side. The project cost was planned to be 1,499 million yen, while in reality, the actual project cost was 1,385 million yen, which was within the planned amount (approximately 92% of the planned amount). The main reason for the difference between the planned and actual amounts was the efficient bidding for the construction works.

3.2.2.2 Project Period

This project was planned to be implemented from December 2013 to February 2016 (27 months). In reality the project was implemented from December 2013 to December 2016 (37 months), which was slightly longer than planned (approximately 137% of the plan). The main reasons for the delay are as follows: (1) a law within Timor-Leste changed after the start of the construction work, and it took time for construction workers from other countries (mainly Indonesians) to obtain business visas (approximately three weeks); (2) difficulty in land acquisition led to the interruption of the building construction (temporary suspension of approximately four months); (3) the process of custom clearance for the materials and equipment required time (approximately two months); (4) regarding the production of aggregates for concrete, although a night-time operation of the plant was under consideration, the government of Timor-Leste advised against late night operations. Therefore, the aggregate production could not catch up with the concrete production (delay of approximately one month). These issues ultimately affected the construction period, causing the delay. As a result, the grant agreement (G/A) was extended until December 2015.

As discussed above, the outputs of this project were mostly as planned. Although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

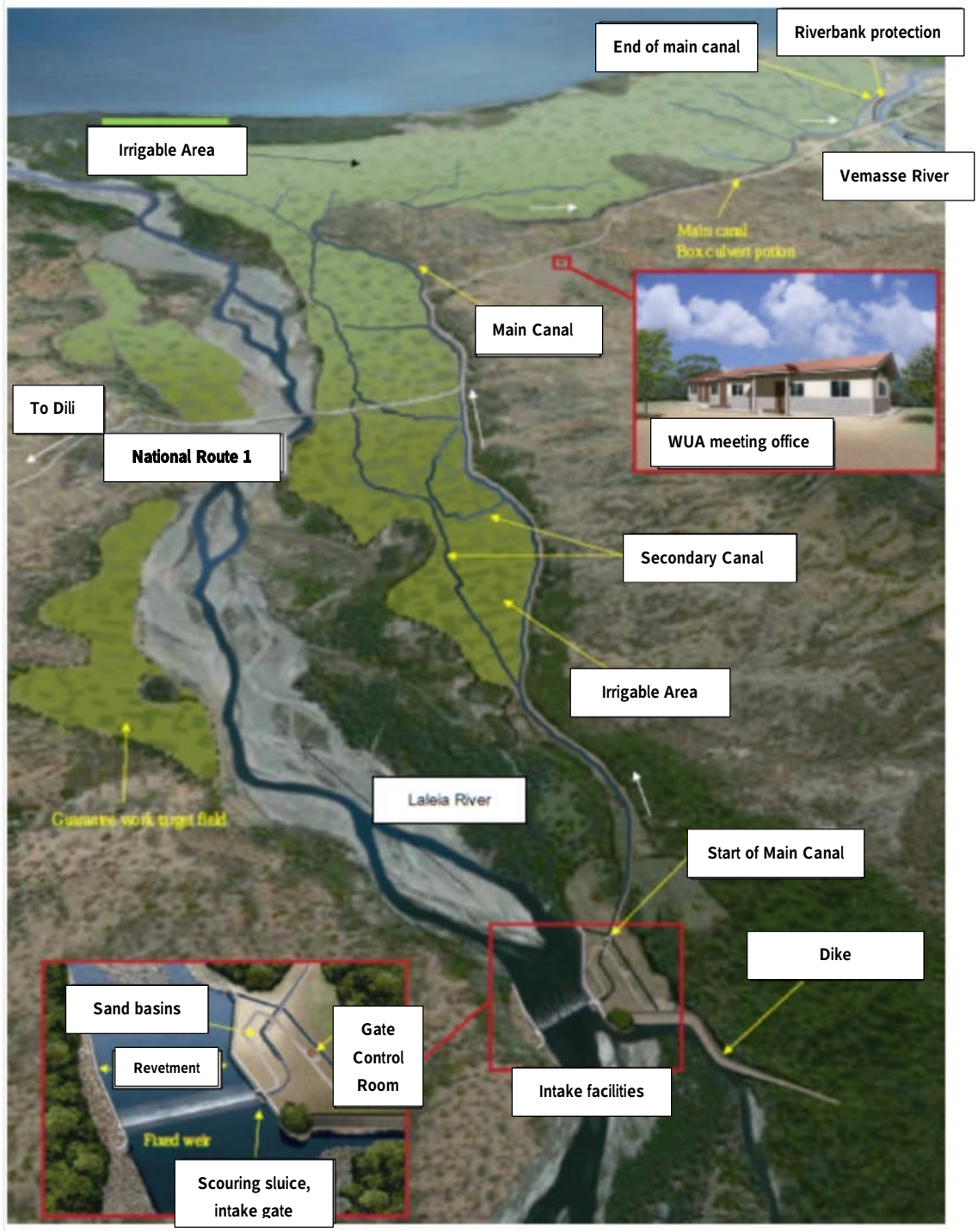


Figure 1: Locations of the project sites (Buluto irrigation area)[9]

[9] Quoted from JICA document (Preparatory Survey Report)

3.3 Effectiveness and Impacts[10] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 2 shows the quantitative effect indicators (baseline, target, actual) related to the Buluto irrigation area.

Table 2: Quantitative Effect Indicators of This Project (Baseline, Target, Actual)

Indicator	Baseline (2012)	Target (2019) 3 Years After Completion	Actual		
			2018	2019	2020 3 Years After Completion
1) Yield of rice	1.87 ton/ha	2.50 ton/ha	2.50 ton/ha	2.50 ton/ha	3.3 ton/ha
2) Planted area of rice *Note 1	473 ha (rainy season), 61 ha (dry season) *Note 2	540 ha (rainy season), 270 ha (dry season)	531.6 ha (rainy season), 0.5 ha (dry season)	426.4 ha (rainy season), 10.5 ha (dry season)	770 ha (rainy season), 33 ha (dry season)
3) Irrigable area *Note 1	331 ha (rainy season), 61 ha (dry season)	540 ha (rainy season), 270 ha (dry season)	531.6 ha (rainy season), 0.5 ha (dry season)	426.4 ha (rainy season), 10.5 ha (dry season)	780 ha (rainy season), 100 ha (dry season)

Source: Document provided by JICA (baseline, target), answers to the questionnaire and responses of JICA's long-term experts (actual)

*Note 1: The planted area refers to the area where the crop is actually planted. The irrigable area refers to the area where irrigation is possible, by distributing water to agricultural land via the stable intake at the weir and the water intake gate of the Laleia River, the water source. No crop other than rice is produced in the Buluto irrigation area.

*Note 2: The rainy season is typically November–June and the dry season is July–October in Timor-Leste.

By developing and repairing the irrigation facilities in the Buluto irrigation area, this project planned to increase the following: 1) yield of rice, 2) planted area of rice, 3) irrigable area. At the time of planning, the target to be achieved was set at three years after completion, which is 2020. Therefore, the target values will be compared with the actual data of 2020 in principle, in order to make a judgement on quantitative effects.

1) The actual yield of rice exceeded the target. One reason is that the irrigation facilities were developed through this project, as a result of which use of irrigation water by farmers increased in the Buluto irrigation area. Another reason is that the damaging impact of drought was reduced during the harvest season as a result of the development of the irrigation facilities. In addition, it was confirmed via the questionnaire and interviews with DINIGUA that, under the guidance of

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

JICA's "Project for Increasing Farmers Households' Income through Strengthening Domestic Rice Production" (hereinafter referred to as "JICA's technical cooperation project"), cultivation techniques have been improved, including weeding management, nursery improvement, transplantation improvement, fertilization and timely cutting, which is another factor affecting the increase in yield. According to DINIGUA, the national yield in 2019 ranged from 2.5 to 4.0 ton/ha, and the Buluto irrigation area is an irrigated area with an increasing trend (3.3 ton/ha in 2020).

2) The planted area refers to the area where the crop is actually planted. 3) The irrigable area refers to the area where irrigation is possible, by distributing water to agricultural land via the stable intake at the weir and the water intake gate of the Laleia River, the water source within the Buluto irrigation area. The planted area and the irrigable area exceed the targets during the rainy season (usually from November to June). According to DINIGUA, one of the factors is that the development of the irrigation facilities has progressed in this area[11]. On the other hand, the actual results have not reached the targets during the dry season (usually from July to October). Timor-Leste is an island country, and small rivers flow north and south through the land. Water sources mainly depend on rainwater that accumulates in the mountainous areas during the rainy season. In the dry season, many rivers are dry, as is the Laleia. The reason why the targets have not been reached is due to water shortages. In the last year or two, there was less water than initially expected. According to DINIGUA, "the planted area and irrigable area in the dry season are increasing, although they are not as originally expected. In addition to this project, there is support such as development of a farmers' market with the support of JICA's technical cooperation project, and the local farmers' interest in and motivation for rice production are increasing more than before. However, it is not easy to address the water problem during the dry season." On the other hand, the project expert commented, "Irrigation water is not available in some parts of the Buluto irrigation area. In the past, water was taken directly from the Laleia River for each branch of the irrigation canal, and water was abundant. With the irrigation facilities, only the required volume of water based on the calculation is distributed. In some areas, farmers who cultivate upstream of the secondary canal are better off, while those who cultivate downstream do not get water[12]. That can be one of the reasons why the planted area has not increased as much. Apart from that, to increase the planted area, improvements in farming activities, such as improving cultivation

[11] The actual values did not increase much until 2019, as the years prior to this were inferred to be the period required for the effects of the irrigation facility development to become evident (build-up period).
[12] This occurs mostly in the dry season.

history[13], can be considered[14].” While there is an issue of water shortages in the dry season, to improve the situation, a systematic flow management and review as needed and continue technical support so a designated irrigation period is followed are believed to be significant.

Subsequently, for reference, Table 3 shows the agricultural production volume (actual value) of the Buluto irrigation area over the last three years. Both the agricultural production volume and the collection rate of water usage fees have increased significantly in 2020, the third year after the project’s completion. 1) The agricultural production volume (ton) is calculated by “multiplying the yield by the planted area” shown in Table 2. The production in 2020 greatly increased from the previous year, based upon which it may be claimed that rice production has increased.

(Reference) Table 3: Agricultural Production Volume (Actual) in Buluto Irrigation Area

(Unit: ton)

2018	2019	2020 3 Years After Completion
1,331	1,092	2,650

Source: Answers to the questionnaire, responses from DINIGUA and long-term experts of JICA’s technical cooperation project. The agricultural production (ton) was calculated by the external evaluator, based on the yield per ha, multiplied by the planted area from Table 2.

3.3.1.2 Qualitative Effects (Other Effects)

In this evaluation study, we conducted an interview survey[15] with staff from the DINIGUA Headquarters, the agricultural offices of the Manatuto and Baucau districts and the water users’ association. The answers were as follows:

A representative from the DINIGUA Headquarters commented on the interviews, “because the development of infrastructure facilities, such as irrigation canals, weirs and intake weirs in this project are visible and a stable supply of agricultural water is expected, farmers in the Buluto irrigation area are more motivated to produce rice than previously. They are also expecting the sales of rice to increase at the markets.” “Due to the improvement of the main canal as a result of

[13] The growth of rice and the cultivation method are recorded over time. Agricultural activity fact data (practice record data).

[14] It was pointed out that planting may increase by properly managing and adhering to the irrigation period and the ripening days of the recommended varieties.

[15] A total of seven people were selected, who could judge the situation before and after the project. The questions were as follows, “Do you think agricultural production volume and income are improving? Do you feel that your standard of living has increased?” “Is there enough water in the dry season? Did that help you secure sufficient yield?” “Is the sales channel expanding for agricultural products?” “To what extent have labor efficiency and agricultural productivity improved as a result of the concrete lining of main canal?” “Did the development of maintenance road of this project make it easier for agricultural machinery and vehicles to pass through?” “How much progress has been made in improving labor efficiency and agricultural productivity through the development of management roads?” “Are there any secondary impacts (e.g., leisure, schooling opportunities)?” “Is there any change in your motivation to engage in agriculture due to this project and why?”

this project, there is less retention of water flow, which has reduced the labor required for soil canal repairs." "Maintenance roads along the irrigation canals facilitate the transportation of agricultural machinery and vehicles and are contributing to the increase in efficiency of rice production." In addition, the staff of the agricultural offices of the Manatuto and Baucau districts, who are responsible for the maintenance of the irrigation facilities, as well as the water users' association staff, who are closer to the farmers and are responsible for the cleaning and small-scale repairs of the irrigation facilities, commented on the interviews: "This project has greatly benefited the entire irrigation area. Rice productivity is improving." "Before the start of this project, rice was cultivated by traditional methods and productivity was low, but after the completion of this project, water from the Laleia River is taken in from the intake facility and water is systematically distributed to each irrigation area. Farming has become efficient." "Farmers usually earn 0.4 USD per kg of rice (cash income). However, recently, due to the influence of COVID-19, a shortage of imported rice is expected, so some farmers decided not to sell rice for a while, either for self-consumption or in anticipation that prices may increase." On the other hand, there were also comments such as: "During the dry season, the volume of water intake becomes less and we get little water from the developed irrigation canal, which greatly limits the area where we can plant." "Water is not distributed to areas far from the irrigation canal (e.g., the Garemarak area)."

Based on the above, it is presumed that this project has contributed to the increase in motivation for rice production, an increase in rice production volume, the reduction of labor required for the irrigation canal maintenance, improvement of rice production efficiency by developing the maintenance roads, and particularly the increase of farmers' willingness to produce rice in the dry season. However, apart from the fact that water was not distributed from the irrigation canal during the dry season due to the water usage problems among local farmers, it was also found that water was not distributed as planned[16] in some areas. As previously mentioned, it can be said that a systematic management and review of the upstream and downstream flows in the entire irrigation area is an issue.

[16] It has also been reported that there are cases of illegal water intake from some areas that do not belong to the designated irrigation area. At the time of the ex-post evaluation, all of these issues are being addressed by JICA's technical cooperation project.

Photo 4: Buluto irrigation area (Dry season)

3.3.2 Impacts

3.3.2.1 Intended Impacts

(Contribution to Improving Food Self-Sufficiency in Timor-Leste)

At the time of planning, the "contribution to improving the food self-sufficiency rate in Timor-Leste" was considered as an impact of this project. Regarding this point, as shown in Table 4, this evaluation study obtained agricultural statistical data, upon which the observations of rice production and food self-sufficiency after the start of this project are based; the way in which these are related to this project is described below.

Table 4: Changes in Rice Harvest Area, Unit Yield, Domestic Production and Imported Rice After the Start of This Project[17]

Indicator	2014	2015	2016	2017	2018	2019 2 Years After Completion
(1) Harvest Area (unit: ha)	28,483	18,281	10,745	11,861	18,047	22,328
(2) Unit Yield (unit: ton/ha)	3.12	3.30	3.34	3.12	3.37	3.57
(3) Domestic Production (unit: ton)	88,822	60,361	35,361	36,982	57,418	79,703
(4) Imported rice (unit: ton)	222,274	300,000	115,786	143,344	135,847	81,049
(5) Domestic Supply (3) + (4) (unit: ton)	311,096	360,361	151,147	180,326	193,265	160,752

Source: Data of the National Directorate of Agriculture and Horticulture, Ministry of Agriculture and Fishery of Timor-Leste (Global Trade Atlas, Aportil, IP.)
Remark: 2020 data could not be obtained.

[17] 2020 data could not be obtained.

Before the start of this project (2013), the need to increase rice production in order to realize food security and economic development was recognized in Timor-Leste. Under such circumstances, it was expected that this project would contribute to improving the farming environment of farmers, increasing the rice harvest and eventually strengthening the food self-sufficiency system of the country as a whole. Regarding the trend of data shown in Table 4, no specific factor analysis has been conducted in the country. However, through the communication with the representative in charge of DINIGUA and the long-term experts of JICA's technical cooperation project, the following was confirmed. Before and after the start of this project, the international price of rice started decreasing which, in turn, increased the volume of cheap imported rice in the country. As a result, the rice farmers' motivation to produce started to decline. This trend continued until the period 2014–2015. In 2016, although the amount of imported rice decreased as a result of a surplus supply of rice accumulated through the previous year, the harvest area and domestic production did not increase to a great extent, as the farmers' motivation to produce remained low. Since 2017, there has been a reaction. Although the following cannot be deemed to be solid facts, the information obtained was confirmed via the interviews: stable production mainly during the rainy season has become possible, as irrigation facilities are developed throughout the country; planting has increased due to the increase in rice farmers' interests in learning cultivation techniques; there is a trend to use fertilizer for paddy rice which used to be grown without fertilization, leading to an increase in yield. It is thought that the (1) harvest area and the (3) domestic production in Table 4 are gradually increasing for these reasons. As shown in Table 3 above, the production volume of the Buluto irrigation area is 1,052 ton, which is a small proportion of the domestic production (total) of 79,703 ton. Considering this, its contribution is not large. However, through the development of irrigation facilities as a result of this project, the production volume in the area is on the rise after 2020. In addition, an increase in unit yield is expected due to the synergistic effect with JICA's technical cooperation project[18]. An increase in rice production within the Buluto irrigation area is expected to play a role in the country's rice production system as a whole and is thought to contribute to improving the rice self-sufficiency rate in the future.

[18] Various activities are being carried out to improve the rice value chain process (capacity building), and it has been concluded that the degree of correlation and collaboration with this project is high. In November 2020, a discussion was held between JICA and Timor-Leste, and yield in this area was targeted to reach 4.5 ton/ha through this project by 2023 (reference: 3.3 ton/ha in 2020). Expectations for improving rice productivity are thought to increase in the future, which will lead to a stable supply of rice and an improvement in the food self-sufficiency rate.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

According to the *Japan International Cooperation Agency Guidelines for Environmental and Social Considerations* (promulgated in April 2010), this project was classified as Category B, as the undesired impact on the environment would not be significant. In addition, under the domestic law of Timor-Leste, the initial environmental survey was prepared by DINIGUA and approved by the Ministry of Commerce, Industry and Environment in October 2013.

It was confirmed by the questionnaire and interviews that there were no negative impacts on the natural environment (e.g., air pollution, vibration, noise, ecosystem, etc.) around the developed irrigation facilities during and after the project was completed. The impact on the natural environment around the irrigation facilities was visually checked in this evaluation study, and no particular problems were found.

The environmental division within the Ministry of Economy of Timor-Leste is responsible for the environmental monitoring of infrastructure facilities, including the ones developed in this project. To date, no monitoring activities or measures have been implemented in particular, as no major negative impact on the environment has occurred. Should any negative environmental impact be observed in or around the Buluto irrigation area, resulting from the developed irrigation facilities, a system is in place to deal with the issue, based on consultation with the relevant parties, including the environmental division.

2) Resettlement and Land Acquisition

It was confirmed that no involuntary resettlement occurred concerning this project. As land acquisition was required for the water intake facility and the widening/expansion of part of the main and secondary canals (approximately 19 ha), with the consent of the landowners (around 320 people), land acquisition was conducted, based on voluntary provision.

Usually, when land is acquired for public infrastructure projects, it will follow the *Japan International Cooperation Agency Guidelines for Environmental and Social Considerations* and the domestic law of the recipient country, according to which compensation is paid. However, in Timor-Leste, it was difficult to identify accurate land information, as land registries and cadastral maps were lost during the independence conflict around the year 2000. In addition, customary land users are, in fact, recognized by the local community especially in rural areas. Furthermore, regarding land acquisition related to the implementation of public work projects with a relatively minor impact, the government or the project-implementing body typically enters into a discussion

with the residents to donate the land in accordance with the rules of the local community. Given this custom, the project considered a process in which the Timor-Leste side, i.e., the project-implementing body, explained to the relevant people about providing the land voluntarily, based on the discussions and rules of the local community. According to the World Bank, the voluntary provision of land constitutes a transfer without exercising any power such as land acquisition rights. As a general rule, this would only apply if it involved the "right to choose[19]" and "informed consent" at the stage when the planned project implementation site is not clear. In this project, several public hearings were held between the Timor-Leste side and local residents regarding the "right to choose" at the time of planning. As a result, agreements were reached on a partial provision of the agricultural land. At that time, one landowner refused to provide the land, and part of the plan was altered. This indicates that the "right to choose" was granted to the people affected by the implementation of this project. In addition, informed consent was implemented without major deviation from the standards set in the World Bank's sourcebook. Furthermore, there was an understanding on the part of the landowners that rice productivity would increase from the development of irrigation facilities and rice production would increase due to the increase in the planted area, which would greatly exceed the decrease in production due to the reduction of land (agricultural land). This promoted the affected population's understanding of the project. As a result, land was voluntarily provided by the landowners, and no monetary compensation was provided by the project implementer[20]. From that point of view, this process cannot be recognized as land acquisition in a strict sense, according to DINIGUA.

There had been no complaints regarding land acquisition until the time of the ex-post evaluation. In addition, as previously discussed, one landowner refused to provide his land, and as a result, the meeting house of the water users' association and its access road, which had been planned to be developed in Laleia within the Buluto irrigation area, were affected. Alternatively, they were constructed in the sub-district of Vemasse.

[Summary of Effectiveness and Impact]

1) The rice yield, an effectiveness/quantitative effect indicator, exceeded the target. Regarding the 2) planted area of rice and the 3) irrigable area, the actual values exceeded the targets in the rainy season but were below the targets in the dry season; the total values of the rainy season and

[19] This means that the person has an opinion for or against the land acquisition, without being pressured by the state or government.
[20] This means that they did not need to handle the matter according to the compensation payment rule, based on national law.

the dry season were generally close to the target. It was observed from the interviews with DINIGUA that this project is positively impacting the farmers' motivation for rice production, the increase in production volume and the reduction in labor required to maintain the irrigation canals, thereby contributing to the efficiency of rice production. In addition, from the interviews with representatives from the agricultural offices of the Manatuto and Baucau districts, responsible for the maintenance of irrigation facilities, and the water users' association staff, who are closer to the farmers and are in charge of cleaning and small-scale repairs of the irrigation facilities, it was observed that this project is contributing to the motivation for rice production. An increase in production volume, the reduction of labor required for irrigation canal maintenance and the improvement of rice production efficiency by developing the maintenance roads were also observed by the interviews. Regarding the project's impact, while it cannot be concluded that the role of this project is extensive in terms of increasing the country's domestic supply of rice and improving the food self-sufficiency rate in Timor-Leste as a whole, it can be said that this project plays a role in the rice production system of the country. In addition, with JICA's technical cooperation project, the aim of which is to improve rice productivity and farmers' livelihoods, synergistic effects are expected in the future. Considering the above, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

The executing agency of this project is DINIGUA, a department within the Ministry of Agriculture and Fisheries. While DINIGUA is responsible for the overall management of this project, the agricultural offices of the Manatuto and Baucau districts, namely, the local branches of the ministry, are responsible for the operation and maintenance of the developed irrigation facilities[21]. Taking the command system from DINIGUA to local and field levels as an example, DINIGUA gives instructions to the regional agricultural office (local organization of the Ministry of Agriculture and Fisheries) that cover the two districts. The regional agricultural office then coordinates with the district agricultural offices. The roles of the regional agricultural office are: 1) coordination, 2) supervision, 3) evaluation and 4) reporting to the central headquarters (DINIGUA). The regional agricultural office supervises the operation and maintenance at site level, while the district agricultural offices are responsible for the actual operation and

[21] Decentralization progressed in Timor-Leste after the start of this project and since FY2017, both district agricultural offices have been organized into sub-organizations at district level.

maintenance of the irrigation facilities, including the intakes and the main canal. It was confirmed via the questionnaire and interviews that the two district agricultural offices and the regional agricultural offices have mutually cooperative relationships under DINIGUA's management. In addition, the water users' association, which has been established with the support of this project, is responsible for the maintenance of secondary and tertiary canals[22]. Farmers who belong to the water users' association conduct sand removal, cleaning such as weeding and small-scale repairs of secondary and tertiary canals.

There are seven staff at the aforementioned regional agricultural office, 118 at the Manatuto district agricultural office (among whom are two gatekeepers, who manage the water gates and covers the Buluto irrigation area), 105 at Baucau district agricultural office (among whom are two gatekeepers with similar responsibilities) and eight at the water users' association within the Buluto irrigation area. When we interviewed each organization, comments such as, "we are allocating the appropriate number of on-site staff as required" were received. Therefore, it is believed that there is no shortage of staff.

Based on the above, it was concluded that there are no particular problems with the institutional/organizational aspect of the operation and maintenance of this project.

3.4.2 Technical Aspect of Operation and Maintenance

At the time of the ex-post evaluation, the agricultural offices of the Manatuto and Baucau districts and the water users' association have staff with abundant work experience. On the other hand, DINIGUA points out the need to improve knowledge by attending regular training. In this project, training, as part of its soft component, was provided to DINIGUA, to the gatekeepers of the district agricultural offices and to people associated with the water users' association, based on three concepts: support for the establishment of the water users' association, the operation and maintenance of irrigation facilities and guidance on water management[23]. When the training was conducted, for example, a questionnaire was distributed and participants were asked to submit their answers at the end of the gate maintenance operation training for the weirs and main canal, so as to enhance participants' understanding regarding the functions and operation methods of

[22] At the time of the ex-post evaluation, the head of the water users' association is from the Manatuto district (Laleia sub-district) and the deputy is from the Baucau district (Vemasse sub-district), indicating the intent to prevent bias.
[23] This was approximately one year from 2015 to 2016. The training was conducted because the water users' association needed to play a role in the operation and maintenance work after the facility was completed, thus it was also necessary to strengthen its organizational management capabilities. In addition, it was important to provide technical guidance on the operation of the irrigation facilities to be developed and to prepare water management guidelines, in order to ensure appropriate operation and maintenance.

each facility. The participants, who had no prior basic knowledge, deepened their knowledge by receiving the training for the first time.

Specific “On the job training (OJT)” has not been conducted so far, however, according to DINIGUA, training and workshops have been held as required since 2016, with the support of the aforementioned JICA’s technical cooperation project, and the staff of each organization involved in this project, including the water users’ association, are maintaining their technical level.

The aforementioned gatekeepers are utilizing manuals for the operation of the main facilities around the weir, such as the intake and scouring sluice, and the main canal’s diversion facilities as required.

Based on the above, it was concluded that there are no particular problems with the technical aspect of the operation and maintenance of this project.

3.4.3 Financial Aspect of Operation and Maintenance

Although DINIGUA submitted budget requests to the central government for the maintenance of the developed irrigation facilities, there has been no allocation of funds since 2015[24]. For this reason, in the Buluto irrigation district, regular repairs, repairs relating to damages and large-scale repairs have not been carried out in relation to the weirs, intakes, sand basins and main canal; the maintenance has been limited to small-scale repairs and cleaning. Under such circumstances, the agricultural offices of the Manatuto and Baucau districts are striving to handle the budget shortage situation by trying to maintain irrigation facilities with their own heavy machinery[25], so as to ensure ease of water use during the cultivation season. DINIGUA has indicated that a high-level policy decision will determine whether or not the central government can provide a budget. The salaries of maintenance staff and the costs of owning heavy machinery are provided by the agricultural offices of both districts, and the water users’ association uses the collected irrigation water fees[26] for cleaning and for small-scale repairs of the irrigation facilities. Nevertheless, it is a concern that the government has not allocated any budget for periodic and large-scale repairs (e.g., repairs required in the event of damage). (The irrigation water fee collection rate will be

[24] The operation and maintenance budget which was requested recently for 2020 was not approved. According to DINIGUA, not only the facilities covered by this project but also irrigation facilities in other areas (state-owned irrigation projects) are facing the same issue.
[25] The salaries of the maintenance staff (four gatekeepers in total) are also paid by the agricultural offices of both districts.
[26] According to DINIGUA, the collected irrigation water fees for the latest year, 2020, equated to approximately 1,056 USD (in reality, 12 barrels of harvested rice were given to the water users’ association by 220 farmers).

explained below.) The financial resources of the central government are by no means abundant, and from these limited financial resources, budgets are allocated to each ministry/agency. With the limited funds, each ministry/agency budgets for its operation and infrastructure development. This is likely to be the reason why DINIGUA is not allocated a sufficient budget for the maintenance of the irrigation facilities.

Based on the above, it has been concluded that there are concerns regarding the financial aspect of the operation and maintenance of this project.

For reference, Table 5 shows the water users' fee collection rates (actual) within the Buluto irrigation area over the last three years. Until 2019, irrigation water fees were not collected due to the time spent on the voluntary enactment of the irrigation association rules. The water users' association was organized at the end of 2019, and in 2020, full-scale activities began with the support and guidance of JICA's technical cooperation project. Through the support of this project, a traditional irrigation manager, by the name of Kabwee, has been given responsibility for collecting irrigation water fees, which has helped achieve high collection rates[27]. It also helped that local government offices had issued documents to farmers concerning the payment of irrigation water fees. According to DINIGUA, "local farmers are more motivated to cultivate and have a better understanding of the irrigation project. It is expected that the payment of irrigation water fees will continue in the future." Since the collected irrigation water fees are used for maintenance, such as cleaning and the repair of irrigation canals, the awareness of voluntary management on the part of the water users' association is expected to improve.

(Reference) Table 5: Irrigation Water Fee Collection Rate in the Buluto Irrigation Area (Actual)

2018	2019	2020 3 Years After Project Completion
0%	0%	81.6%

Source: Answers to the questionnaire, responses of DINIGUA and long-term experts within JICA's technical cooperation project

3.4.4 Status of Operation and Maintenance

The operation and maintenance of the irrigation facilities in the Buluto irrigation area is routinely handled by the gatekeepers, dispatched from the agricultural offices of the Manatuto and Baucau districts. Specifically, the district agricultural offices are in a position to supervise the

[27] However, the irrigation water fee is only collected in the rainy season.

weirs, intakes, sand basins, main canals, etc., and the gatekeepers operate and maintain the irrigation facilities at the request of the water users' association and the local farmers. The water users' association staff and the member farmers are engaged in cleaning (sand removal, weeding, etc.) and small-scale repairs[28].

Regarding spare parts for the irrigation facilities, the sites are provided with some spare parts, even though the expenses from DINIGUA is small every year. However, as mentioned above, no budget has been allocated in recent years, and it cannot be said that the budget has been sufficiently secured. Spare parts are imported from neighboring Indonesia[29].

Based on the above, some minor problems have been observed in terms of the financial aspect. Therefore, sustainability of the project effects is fair.

Photo 5: Water Users' Association (WUA) meeting house developed by this project

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to increase rice production through stable supply of agricultural water, by constructing modern intake facilities and irrigation canals, etc. in the Buluto irrigation area where traditional irrigation methods had been used, thereby improving the food self-sufficiency rate of Timor-Leste. The *National Priority Program* and the *Ministry of Agriculture and Fisheries Strategic Plan*, formulated by the government of Timor-Leste advocate improving rice productivity and food self-sufficiency, and there is a need to improve agricultural productivity

[28] As a follow-up to this project, JICA repaired revetment retaining walls, installed floor protection works and repaired waterways, etc. at the time of ex-post evaluation.
[29] DINIGUA states that it is desirable to import and procure large-scale parts related to intake weirs and intake gates from Japan, from the viewpoint of ensuring quality.

and support farmers' livelihoods in rural areas nationwide, including the Buluto irrigation area. As it is also consistent with Japan's ODA policy, relevance of this project is high. With regard to efficiency, the outputs were almost as planned, and the project cost was within the plan. However, the project period slightly exceeded the plan, mainly because it took time to acquire land around the project site and to process tax exemptions when clearing materials and equipment through customs; thus, efficiency is fair. Regarding effectiveness/quantitative effect indicators, 1) the yield of rice exceeded the target. While the actual 2) planted area and 3) irrigable area exceeded the targets in the rainy season, they did not reach the targets in the dry season. The total values for the rainy and dry seasons combined, were generally close to the targets. In addition, it was confirmed through interviews that this project contributed to the motivation of farmers to produce rice, an increase in production and a reduction in labor required for the maintenance of irrigation canals. Furthermore, synergistic effects with JICA's technical cooperation project, aimed at improving rice productivity and farmers' livelihoods can be expected in the future. Therefore, the effectiveness/impact is high. As for sustainability, there are no particular concerns regarding the institutional/organizational or technical aspects of the executing agency of this project, DINIGUA, or the water users' association. While there are no particular problems with the operation and maintenance status of the developed irrigation facilities, a budget has not been allocated in recent years for the regular repairs, repairs relating to damages or large-scale repairs of intake weirs, intake gates, sand basins and waterways, which needs to be addressed. Therefore, the sustainability of the effects generated by this project 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

- Regarding the planted area and irrigable area, which are quantitative effect indicators, the actual values in the dry season have not reached the set targets. Since 2016, through JICA's technical cooperation project, activities such as weeding management, nursery improvement, transplantation improvement, fertilization and timely harvesting have been taking place for the purpose of improving the cultivation techniques of the farmers in the Buluto irrigation area. On the other hand, one significant factor is the water shortage in the Laleia River, as this is the source of water intake in the area. Irrigation water is not available in certain parts of the area. In some cases, farmers upstream of the secondary canal benefit from the irrigation, however, the water does not reach the farmers downstream. For this reason, it is desirable to carry out systematic

management and a review of the upstream and downstream flows across the entire irrigation area as required.

- Although DINIGUA submitted budget requests to the central government for the maintenance of the developed irrigation facilities (mainly intake weirs, intake gates, sand basins and main canals), there has been no allocation in recent years. The agricultural offices of the Manatuto and Baucau districts use their own heavy machinery to carry out maintenance, while the water users' association and its member farmers are conducting the cleaning and the small-scale repairs. Nevertheless, it is concerning the government does not allocate any budget for regular repairs and large-scale repairs (e.g., repairs needed in case of damage), which can hinder future maintenance. On the other hand, the financial resources of the central government are by no means abundant, and from these limited financial resources, budgets are allocated to each ministry/agency. With the limited funds, each ministry/agency budgets for its operation and infrastructure development. This is likely to be the reason why DINIGUA has not been allocated a sufficient budget for the maintenance of the irrigation facilities they manage. When preparing budgets, it is recommended that the government duly considers the importance of the agricultural sector and irrigation projects, recognizes the feasibility of securing a system for food security and organizes and allocates a budget to the agricultural sector.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

<u>Importance of Steady Allocation of Operation and Maintenance Budget</u>

- Pertaining to the fact that a maintenance budget is not allocated to the developed irrigation facilities, the plan prior to the start of this project was that the central government would support and bear the cost of maintenance for the developed irrigation facilities, given the scale and importance of these facilities. However, at the time of the ex-post evaluation, the government does not necessarily have sufficient financial resources, and the budget allocated to each sector is limited. It is difficult to say that the system of support and cost bearing on the part of the Timor-Leste government, which was planned before the start of this project, is functioning at the time of the ex-post evaluation. The assistant provider and the recipient country should have put some measures in place, such as discussing the maintenance budgets required after the completion in detail and exchanging of documents before the start of the project and during its implementation, so that the required maintenance budget is

allocated. For similar projects in the future, it is preferable for both the assistance provider and the recipient country to work together at the earliest possible stage, in order to secure the maintenance budget required after the project completion.

Republic of Moldova

FY2020 Ex-Post Evaluation Report of

Japanese Grant Aid Project

"Project for Effective Use of Biomass Fuel in the Republic of Moldova"

External Evaluator: Miyuki Koga, Octavia Japan, Co., Ltd.

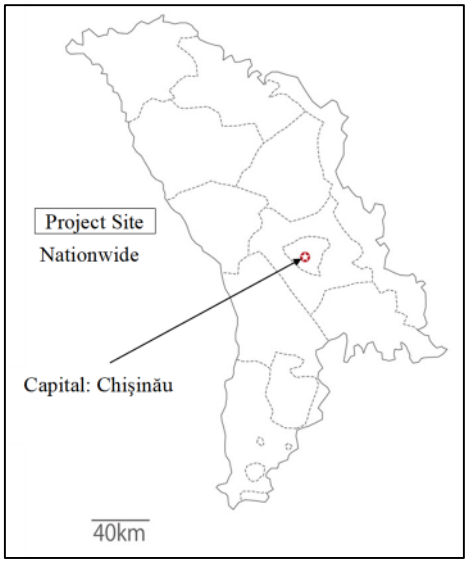
0. Summary

This project aimed to reduce energy cost and enable sustainable operation of heating facilities at public facilities (mainly education facilities such as primary schools) in Moldova by introducing pellet boilers and pellet plant, thereby contributing to the improvement in the living environment of the residents. The *Energy Strategy of the Republic of Moldova until 2020* and the *National Development Strategy Moldova 2030*, formulated by the government of Moldova, advocate improving energy utilization efficiency and reducing energy consumption through biomass fuel and renewable energy. They recognize biomass fuel as a beneficial alternative to natural gas and indispensable for the country's stable energy supply. The project is also in line with Japan's assistance policy and is therefore highly relevant. Regarding efficiency, although the output was generally as planned and the project cost was within the planned budget, the project period was slightly longer than planned as it took time to agree on the pellet boiler connection cost between the executing agency and some local target sites. Therefore, efficiency is fair. With regard to effectiveness, as a result of the decline in natural gas prices since 2018, gas heating tends to be prioritized in the country. As a result, only 9 of the 24 pellet boilers installed in rural areas are in operation at the time of ex-post evaluation. For this evaluation study, targets and actual results were available at 7 of the 9 operating sites; data required to analyze quantitative effects were limited. Keeping this in mind, 1) the heating cost reduction is above the target and 2) job creation was slightly below the target. On the other hand, a means of heating that is cheaper than coal, firewood and electricity, and safer and more environmentally friendly than natural gas, is secured, and heating can be used in winter regardless of the price trend of imported energy in the target areas of this project. The non-operational pellet boilers are scheduled to operate in the future, while the fact that renewable energy makes effective use of agricultural waste is widely known and promoted, and the project is contributing to the diversification of energy sources (energy security) in the country. Therefore, overall, the effectiveness and impacts are judged to be fair. Regarding sustainability, 9 operational pellet boilers have no breakage or malfunctions and 11 non-operational pellet boilers have been connected and are ready for operation from this winter (2021/2022). Thus, no problems are observed in the institutional, technical or financial aspects of

operation and maintenance. However, there is no prospect for the operation and utilization of the pellet plant and the demonstration pellet boiler, and concerned parties need to discuss the solution. Therefore, the sustainability of the effects generated by this project is fair.

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

1. Project Description



Project location

Pellet boiler introduced by this project

1.1 Background

Moldova is poor in mineral resources such as oil and coal and relies on imports from neighboring countries, namely, Russia and Ukraine, for most of its energy sources such as natural gas and coal. Energy used to be provided cheaply by the former Soviet Union before independence in 1991. However, since independence, Moldova has been purchasing fuel based on international market prices. From 2006 to 2010, before the start of this project, the price of natural gas more than tripled and fuel purchase costs were putting pressure on national finances. Especially in rural areas, because of financial difficulties of the government, it was not possible to purchase a sufficient amount of fuel (natural gas) in the midwinter. Particularly in rural areas where heating could not be supplied, there were cases where schools had to temporarily close in winter. Therefore, securing a stable heating supply was an urgent issue. Under such circumstances, expectations were rising for improving the energy situation by utilizing straw, etc. that can be obtained domestically in large quantities from rural areas as biomass resources and by introducing pellet boilers.

1.2 Project Outline

The objective of this project is to reduce energy cost and secure heating facilities at public facilities (mainly education facilities such as primary schools) in Moldova by introducing pellet boilers that use biomass (pellet) as fuel and pellet plant, thereby contributing to the improvement in the living environment of the residents in the target areas.

Grant Limit / Actual Grant Amount	1,154 million yen / 1,025 million yen
Exchange of Notes Date / Grant Agreement Date	June 2013 / June 2013
Executing Agency(ies)	(At the time of Planning) 2KR-PIU, Minister of Agriculture and Food Industry (At the time of Ex-Post Evaluation) Agency for Development and Modernization of Agriculture (ADMA): hereinafter referred to as “executing agency”
Project Completion	January 2016
Target Area	Allover Moldova (25 locations for the pellet boilers, 1 location for the pellet plant)
Main Contractor	None
Main Consultant	Mitsui Consultants Co., Ltd., UNICO INTERNATIONAL CORPORATION (JV)
Procurement Agency	Toyota Tsusho Corporation
Preparatory Survey	December 2011–March 2013
Related Projects	(Grant Aid) - Grant Assistance for Grassroots Human Security Projects “Improvement of Heating System for the Kindergarten and School in Hirtopul Mare Village” (2008) (Other International Organizations and Aid Agencies) - “Moldova Energy and Biomass Project” (2011–2014, United Nations Development Programme (UNDP) - “Moldova Energy and Biomass Project Phase 2” (2014–2018, United Nations Development Programme

	(UNDP) - "Energy II Project" (2004–2011, World Bank) - "Renewable Energy from Agricultural Waste Biomass Project" (2005–2008, World Bank) - "Social Investment Fund II Project" (2004–2013, World Bank)

2. Outline of the Evaluation Study

2.1 External Evaluator

Miyuki Koga, Octavia Japan, Co., Ltd.

2.2 Duration of Evaluation Study

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

Duration of the Study: December 2020–December 2021

Duration of the Field Study: The project involved a field survey with no international travel; it was conducted remotely using a local survey assistant.

2.3 Constraints during the Evaluation Study

(Conducting Remote Field Surveys Using Local Survey Assistant)

Two international visits to Moldova were planned for this evaluation study before it commenced. Due to the spread of COVID-19 after the study began, the external evaluator did not travel internationally. Using the local survey assistant, the external evaluator conducted the site visits, collected information and data and conducted interviews with the individuals concerned remotely. The external evaluator analyzed the information collated to conduct the evaluation and make a judgment.

3. Results of the Evaluation (Overall Rating: C[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Moldova

Prior to the start of this project, the government of Moldova formulated the *National*

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

[2] ③: High, ②: Fair, ①: Low

Development Plan in 2012, in which "education," "improvement of road network," "fund access," "business environment," "efficient energy use," "pension reform" and "governance by law" were listed as seven national priorities. Of these, concerning energy, the aim was to improve the efficiency of energy utilization and reduce energy consumption through the use of renewable energy. The government also formulated the *Energy Strategy of the Republic of Moldova until 2020* and the *Government Action Plan* (2011–2014), in which energy efficiency, promotion of renewable energy utilization and biomass utilization were emphasized as specific goals.

At the time of the ex-post evaluation, the government of Moldova formulated the *National Action Plan* (2019–2021) and the *National Development Strategy Moldova 2030*, in which promotion of renewable energy usage is placed as an important aspect of the main energy strategy action plans. The government also plans to promote the reduction of greenhouse gas emissions domestically and improve the efficiency of energy utilization. In addition, the government continues to place importance on biomass used for heating public facilities and homes. Specifically, biomass utilization is positioned as a means to diversify energy sources, which can reduce the country's dependency on natural gas imports and strengthen the national energy security system.

The above shows that promotion of the use of renewable energy was positioned as a main action plan of the energy strategy before the start of this project and at the time of the ex-post evaluation. The utilization of biomass fuel is also regarded as important. Therefore, the project's relevance is recognized in terms of policy and measures.

3.1.2 Consistency with the Development Needs of Moldova

Before the project began, the price of natural gas in Moldova more than tripled from 2006 to 2010 and fuel purchase costs were putting pressure on national finances. Especially in rural areas, because of financial difficulties of the government, it was not possible to purchase a sufficient amount of fuel (natural gas) for heating in the midwinter. Particularly in rural areas where heating could not be supplied, there were cases where schools had to temporarily close in winter. Therefore, securing a stable heating supply was an urgent issue. Under such circumstances, expectations were rising for improving the energy situation by utilizing straw, etc. that can be obtained in large quantities domestically from rural areas as biomass resources and by introducing pellet boilers.

At the time of the ex-post evaluation, biomass resource utilization continues to hold national importance in Moldova. Its advantages are numerous: it can replace natural gas, which is the main

heating source[3]; a heating system using pellet boilers is cheaper to operate and maintain than a system that uses coal, firewood and electricity; it can prevent outflow of funds previously used for fossil fuel purchases; it can form a new industry through local production for local consumption of biomass fuel; and it can create new employment opportunities. Since 2018, the selling price of natural gas in Moldova has been relatively stable[4]. However, even if the price rises sharply again and it becomes scarce in the future, public facilities such as schools can switch to biomass fuel and thereby avoid the situation where heating is not available[5]. In other words, installing a heating system using pellet boilers in addition to the existing heating system (gas, coal, electricity, firewood, etc.) will increase stability in the energy supply. From that point of view, it can be judged that the needs of this project continue to be high.

Based on the above, biomass fuel contributes to strengthening the stable energy supply system in Moldova before the start of this project and continues to do so at the time of ex-post evaluation, and therefore, this project is consistent with development needs.

3.1.3 Consistency with Japan's ODA Policy

The 2013 Official Development Assistance (ODA) Country Databook concerning Moldova indicated the direction that Japan would "aim to improve the living standards of the citizens and give consideration to building a foundation for economic development through the improvement of socio-economic infrastructures."

Considering that this project was designed to promote the utilization of biomass fuel, a renewable energy, to reduce energy costs, and to contribute to the improvement of the living environment of the residents in Moldova, it is consistent with Japan's ODA policy.

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.

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[3] According to the law of Moldova (Art. 13 and 14 of Law no. 128 of 11.07.2014 on the energy performance of buildings), it is highly recommended to consider high efficiency alternative systems utilizing renewable energy sources, etc. when constructing or renovating buildings.

[4] In the fourth quarter of 2020, the price of natural gas supplied by a major natural gas producer and supplier (Gazprom) in Moldova was 114.5 USD per 1,000 m³. This is cheap—about half of the price of what is distributed in European countries. In addition, the average price of natural gas imported by the country in 2020 is 149 USD per 1,000 m³, which is lower than the average import price of European countries of 186 USD per 1,000 m³ (the source of above data is the executing agency). At the time of the ex-post evaluation, the current domestic price of natural gas is cheaper than that of 2015. Moldova has been dependent upon the former Soviet Union and Russia to procure natural gas for decades. With the completion of the gas pipeline from neighboring Romania in 2020, Moldova's price bargaining power and gas procurement capacity have increased, which has an impact on the purchasing price. Nevertheless, it is difficult to predict future prices of natural gas.

[5] According to the executing agency, it is estimated that sufficient biomass resources such as straw can be secured in Moldova and that approximately 1.8 million Gcal per year of thermal energy can be generated.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Table 1 shows the planned and actual outputs of this project.

Table 1: Plan and Actual Outputs of This Project

At the Time of Planning (2013)	Actual (2020)
[Planned Inputs from the Japanese Side] 1) Equipment Procurement, etc. [Equipment] 1 pellet plant, 25 pellet boilers (including one demonstration boiler[6]), 25 prefabricated buildings for the pellet boilers (including, transportation, delivery, assembly, installation, test run, initial operation guidance of procured equipment) 2) Consulting Service Design confirmation, preparation of bidding documents, supervision of the bid and procurement 3) Soft Component Build a maintenance management system by providing the following: (1) training on pellet boiler maintenance (2) training on pellet plant maintenance (3) support for public relation activities to increase the number of pellet boiler users in Moldova	[Actual Inputs from the Japanese Side] 1) Equipment Procurement, etc. [Equipment] 1 pellet plant, 25 pellet boilers (including one demonstration boiler), 25 prefabricated buildings for the pellet boilers: <u>as planned</u>[7] 2) Consulting Service: <u>as planned</u> 3) Soft Component: <u>mostly as planned</u>
[Planned Inputs from the Moldovan Side] (Concerning Pellet Boilers) - Construction of an appropriate foundation for the module (including construction materials) - Works to make electricity and water available to the modules - Fire prevention and extinguishing system - Containers to store ash temporarily - Facilities for boiler operators (e.g., showers, toilets) - Recruitment of boiler operators (Concerning Pellet Plant) - Building for the pellet plant	[Actual Inputs from the Moldovan Side] (Concerning Pellet Boilers) Almost as planned. The differences in the plan are as follows: - recruitment of boiler operators: <u>operators were recruited at seven of the nine operating sites</u> (Concerning Pellet Plant) Almost as planned. The differences in the plan are as follows:

[6] It was set up to present an example of the effective use of domestic resources and to give demonstrations.

[7] (Reference) The introduction cost of the pellet plant (1 unit) was 289 million yen. The total installation cost of the pellet boilers (25 units) was approximately 617 million yen, and the average installation cost per unit was approximately 24.7 million yen.

- Pellet transportation equipment (crane, forklift, etc.) - Constructions related to electricity and water supply - Fire prevention/extinguishing equipment - Facilities for operators (showers, toilets, etc.) - Recruitment of operators	- Pellet transportation equipment (crane, forklift, etc.): not implemented - Recruitment of operators: not implemented

Source: documents provided by JICA, answers to the questionnaire

The actual outputs from the Japanese side and the Moldovan side were generally implemented as planned, although some site changes and delays occurred. The differences between the plan and the actual results will be explained below.

(Inputs from the Japanese Side)

One change from the time of planning is that three local sites (Bubuieci, Pilrita, Siscani) that had planned to introduce pellet boilers became unable to cover the costs required for equipment installation, etc., and these three sites expressed that they would like to decline the offer of introducing the boilers. For this reason, alternative sites (Larga, Cotova, Burlacu) were selected by the executing agency, and JICA approved this decision after confirming the situation. Since the selection was made from the 100 priority sites that were initially listed as candidates at the planning stage, there were no major problems in the reselection or decision-making process[8].

Regarding the pellet plant, the initial plan was to install it at the National Training Center (hereinafter referred to as "NTC") in the capital city of Chişinău, however, it was installed at another NTC site, located in Porumbeni village, Criuleni district, about 15 km away. Although the building design permit was granted by the city government of Chişinău, this permit was not subsequently granted, due to the fact that it would violate the Water Area Conservation Law[9] for rivers, etc. at the stage of applying for the construction permit[10]. At the time of the ex-post evaluation, this facility is not operating. The reasons for this, as will be discussed in 3.2.2.2 Project Period, are that it became difficult to secure the required budget for which Moldova was responsible, as a result of the pellet plant construction being delayed; consequently, the plant was

[8] As will be explained in 3.3.1.1 Quantitative Effects (Operation and Effect Indicators), the baseline and target shown in Table 2 were amended slightly.

[9] Law No. 440 of the Republic of Moldova (revised in July 2012)

[10] It is worth noting that the authority of the capital city of Chişinău was also not aware that it violated the Water Conservation Law for rivers, etc., and because this was a transition period from the former Soviet Union system, the law was revised repeatedly and its contents were not properly made known to the general public of Moldova. As for the criteria for the site selection, the following factors were considered: having a water supply, drainage and electrical facilities for the pellet plant, being close (about 15 km) to the center of the capital city, Chişinău, being surrounded by corn fields thereby facilitating the securing of raw materials and the fact that various regulations regarding fire-related laws were not particularly strict.

transferred to the NTC. According to the executing agency, the plant has been an asset of the NTC since October 2016 and, as a result, the executing agency cannot be directly involved in the operational policy of a separate entity subordinated to the same Ministry. In addition, according to NTC, there has been no instruction from the Ministry of Agriculture, Regional Development and Environment, which is a higher government agency, to make the plant operational, and the budget for equipment and machinery inputs (around 500,000 euros[11]), required for starting the operation, had not been allocated at the time of the ex-post evaluation. The NTC also sought a joint venture with a private company, but this was not realized, due to the high input cost. It was also because coordination with related governmental organizations did not materialize. On the other hand, the executing agency has suggested the possibility of budget allocation by patiently working with the Ministry of Agriculture, Regional Development and the Environment and its related organizations; further consultation with each related organization is necessary.

The soft component was planned after the provision of materials and equipment in this project. However, since neither the boiler nor the pellet plant was in operation when the project was completed (January 2016), the staff of the executing agency could not acquire knowledge (promoting understanding of the environmental aspect), and activities, such as pellet boiler management and monitoring, supply chain planning, hands-on training on pellet manufacturing, were not implemented. On the other hand, during the training in Japan, exercise training was conducted by visiting the facility that was actually in operation, and briefing sessions were held for boiler managers.

(Inputs from the Moldovan Side)

Regarding the “recruitment of boiler operators,” we were able to confirm that recruitment was carried out at 7 of the 9 sites where the pellet boiler was in operation, however, we were unable to establish the actual situation in the remaining 2 sites. According to the interviews with the staff of the executing agency and rural sites (target public facilities), the outflow of technology-related human resources from rural to urban areas has been a remarkable social problem in recent years, and it is difficult to secure human resources in Moldova. With regard to “pellet transportation equipment (crane, forklift, etc.)” and the “recruitment of operators,” as discussed above, the pellet plant is not operating, therefore, no procurement or recruitment has been conducted to date.

[11] Approximately 67 million yen, based on the exchange rate at the time of the ex-post evaluation

Photo 1: Heating system utilizing pellet boiler (Kindergarten/cultural facility in Furceni)

Photo 2: Exterior of pellet boiler building (Branesti)

Photo 3: (left) Pellet plant building, (center) Pellet manufacturing equipment, (right) Inside the pellet plant

3.2.2 Project Inputs

3.2.2.1 Project Cost

Regarding the total cost of this project, the initial plan was approximately 1,276 million yen (of which 1,159 million yen was to come from the Japanese side and approximately 117 million from the Moldovan side). The actual total cost is approximately 1,181 million yen (of which approximately 1,025 million came from the Japanese side and approximately 156 million yen from the Moldovan side), which was within the plan (approximately 93%). The cost actually borne by the Moldovan side exceeded the initial plan, as 11 of the 24 rural public facilities, targeted by this project, refused to pay the incidental cost[12] (mainly the cost relating to the

[12] The reason why the rural sites could not secure the budget for the construction work they were supposed to cover is that law was revised during the project implementation; the Ministry of Education instead of the village became the

connection between the boiler and the heat source facility) and, as a result of the coordination, it was decided that the executing agency bear the cost[13]. Although there was a rough agreement on the cost burden between the target public facilities in rural areas and the executing agency before the start of this project, the amount to be borne by the target public facilities was not clear. Regarding the cost burden, it was desirable to establish an agreement between the concerned parties before the start of the project.

3.2.2.2 Project Period

This project was planned to be implemented between June 2013 and March 2015 (22 months). The actual project period was June 2013–January 2016 (32 months), which was longer than planned (approximately 145% of the plan). The main reason for this was the delay in procurement and installation of some of the pellet boilers. As previously discussed, it took time to coordinate with the executing agency in relation to the incidental cost (mainly the cost relating to the connection between the boiler and the heat source facility) at 11 of the 24 rural sites[14]. Nevertheless, overall, it cannot be said that there was a significant delay; the outputs were implemented generally as planned. Therefore, this does not significantly impair the efficiency aspect of this project.

Based on the above, although the project outputs were generally as planned and the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

one to allocate budgets for elementary school facilities. To be more specific, in the original plan, boilers were installed at elementary schools and kindergartens with the village budgets, thus as of 2013 when the bid for this project was made, the village mayors were the contractors. However, due to the law revision in 2014, it became the Ministry of Education that would allocate budgets for elementary schools. For this reason, in areas where elementary school and the village mayor were not on good terms or support for the pellet boiler diminished due to change of village mayors (where mayors preferred gas boilers due to the decrease in gas price), the sites were less motivated to allocate budgets for the construction work that they were supposed to bear. In addition, according to the executing agency, some rural sites (target public facilities) were financially unable to bear the cost.

[13] JICA has approved the use of the 2KR counterpart fund and the executing agency spent a total of approximately 3.58 million Moldovan leu (hereinafter referred to as “MDL”) (approximately 23.7 million yen, converted by 1 MDL = 6.63 yen, an average exchange rate during the project implementation period).

[14] JICA monitored the situation regularly and was in agreement each time.

1. Furceni
2. Branesti
3. Chiperceni
4. Cricova
5. Varzaresti
6. Cimislia
7. Copaceni
8. Mateuti
9. Larga

Figure 1: Locations of project sites
(Locations of the pellet boilers that were operational at the time of the ex-post evaluation and the pellet plant)

3.3 Effectiveness and Impacts[15] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 2 shows the quantitative effect indicators (baseline, target, actual) of this project.

Table 2: Quantitative Effect Indicator of This Project (Baseline, Target, Actual)

Indicator	Baseline 2012	Target 2018 3 Years After Completion	Actual		
			2018 2 Years After Completion	2019 **3 Years After Completion**	2020 4 Years After Completion
1) Heating Cost of Target Facilities	6,753,361 MDL → After the site change 6,858,160 MDL *7 sites that were operational at the time of the ex-post evaluation (calculated): 1,354,607 MDL*Note 1	5,602,845 MDL → After the site change 5,666,313 MDL (-17% of the Baseline) *7 sites that were operational at the time of the ex-post evaluation (calculated): N/A	- *7 sites that were operational at the time of the ex-post evaluation: 1,087,355 MDL (approx. 20% less than the baseline)	- *7 sites that were operational at the time of the ex-post evaluation: 1,113,739 MDL (approx. 18% less than the baseline)	- *7 sites that were operational at the time of the ex-post evaluation: N/A*Note 2
2) Job Creation	Total 24 people → After the site change 27 people in total *7 sites that are operational at the time of the ex-post evaluation (calculated): total 9 people * Note 1	Total 50 people (On average 0.96 persons per site increase from the baseline) *7 sites that are operational at the time of the ex-post evaluation (calculated): N/A	- N/A	- N/A	- *7 sites that are operational at the time of the ex-post evaluation: total 14 people (On average 0.71 persons per site increase from the baseline)

Source: documents provided by JICA (baseline, target), answers to the questionnaire (actual)
Note 1: as at the time of the ex-post evaluation (June 2021), we have acquired data for seven of the nine operational sites. The plan figures were calculated from these data.
Note 2: the heating cost for 2020 was not included, as it had not been calculated by the Moldovan side at the time of ex-post evaluation (June 2021).

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

The effectiveness/quantitative indicators set at the time of planning were: 1) heating cost of the target facilities and 2) job creation. The target year was set at three years after the project completion. As explained in 3.2.1 Project Outputs under Efficiency, the baseline and target of the heating cost changed because the three target sites were changed after commencement of the project.

In this evaluation study, we aimed to acquire actual data for the recent three years (2018–2020) through the questionnaire and field surveys. We subsequently discovered that the boilers were operational at 9 (kindergarten/school, etc.) of the total 24 sites, excluding the demonstration boiler at the time of the ex-post evaluation. According to the executing agency, this is because the price of natural gas declined in 2018 and since then, gas heating facilities have become cheaper to operate and maintain than biomass, as a result of which pellet boiler use did not begin immediately, consequently delaying the start of the operation. Another reason is that 11 of the total 24 sites (each target public facility) could not bear the cost of switching from the existing heating system, therefore, coordination took time[16]. The pellet boilers at these 11 sites had been prepared for operation during the period December 2020–March 2021 and are expected to be used this winter (2021/2022). The remaining 4 sites are refraining from using pellet boilers, due to the cost advantage of using natural gas. On the other hand, it was confirmed through the questionnaire and field surveys that the executing agency and the target public facilities, other than the 4 sites, understood the need to establish an alternative means of heating in preparation for situations, such as soaring natural gas prices, and had, therefore, not postponed the situation, meaning that they were preparing for the operation.

With regard to the quantitative effects, it is necessary to verify these effects, based on the operation results of all 24 sites. However, as previously discussed, most of the sites are “under preparation” at the time of the ex-post evaluation, hence it is necessary to note the constraint that the verification of actual data is not easy at the time of the evaluation work. Therefore, it was judged to be appropriate to verify the effects by limiting these to the sites where the actual data were recorded (boilers that are operational at the time of the ex-post evaluation), and by comparing the actual data with the baseline and target values of these sites. Although 9 sites were operational, only 7 sites actually measured and recorded the data relating to the quantitative effects. Therefore, this evaluation study verified the values of these 7 sites.

[16] Eventually, it was decided that the executing agency would bear the entire cost.

Regarding the 1) heating cost of the target facilities, as shown in Table 2, the target value set at the time of planning was the sum of all sites, and it was expected that the cost would be 17% less than the baseline value. As for the 7 sites where the data are available, the actual cost was 20% less (2018) and 18% less (2019) than the baseline; the reduction rate exceeded the target. Although data acquisition was limited, it can be said that the expected effect was achieved at the facilities where the pellet boilers are operational. The reason for this reduction is that the sites that previously used coal, firewood and electric heating had introduced the pellet boilers, that are advantageous in terms of cost effectiveness.

With regard to 2) job creation, the total baseline value for the 24 regional sites was 27 people; the target was 50 people, meaning that the number of people was expected to increase by approximately 0.96 persons per site. According to the questionnaire and interviews with the executing agency, etc., the total baseline value for the 7 sites, where data were available, was 9 people and the actual value at the time of the ex-post evaluation was 14 people or an increase of 5 people. In other words, the number increased by 0.71 persons per site on average, which is slightly below the target[17]. According to the executing agency, the main reason is the difficulty of securing human resources in rural areas. Another factor was pointed out that the work of heating system operators is limited to winter, and that their income is not stable throughout the year. In addition, it was suggested that the more skilled the person is, the more likely he/she is to migrate to the cities or even outside Moldova. Comparing the initial plan with the actual results, one cannot say that the target has been achieved as described above, however, the number of staff has increased. Nevertheless, each target public facility should continue to devise and make efforts to secure human resources.

3.3.1.2 Qualitative Effects (Other Effects)

By introducing facilities and equipment such as pellet boilers through this project, an alternative to coal/wood/gas/electricity has been established in Moldova. Pellet boilers are utilized at facilities, such as kindergartens and schools, as a means of securing heating during winter, without being affected by trends in natural gas prices, etc. Although there are certain sites where gas boilers are given priority at the time of the ex-post evaluation due to the reduction in the

[17] At the time of planning, the number of staff was expected to increase (by 2 people per site) at the rural sites (target public facilities) which were switching from gas to pellet boilers, while staff numbers were expected to decrease (by one person per site) at the sites switching from coal to pellet boilers. In reality, 5 of the 7 sites switched from electricity/gas to pellet boilers; staff numbers increased by 3 people at one site, that switched from electricity, while the numbers increased by one person per site at the 4 sites which switched from gas boilers.

natural gas price in 2018, there was also a comment from on-site staff that they were convinced that the pellet boiler was safer[18]. As explained in 3.3.1.1 Quantitative Effects, heating costs have reduced at each target public facility, where coal/wood/electricity had previously been used. Considering the safety aspect, it can be said that this project has played a role in improving the heating environment within public facilities in rural areas.

Photo 4: Connection pipes of pellet boiler
(Kindergarten in Cricova)

Photo 5: Pellet fuel before use
(Primary school in Chiperceni)

Photo 6: Kindergarten where pellet boiler has been installed
(Cricova Kindergarten)

Photo 7: Learning room where pellet boiler heating equipment is installed
(Mateuti Kindergarten)

3.3.2 Impacts

3.3.2.1 Intended Impacts

The impact observed at the time of the ex-post evaluation will be explained from the following

[18] There was a comment, “In the gas boiler room there are many dead insects, whereas they are alive in the pellet boiler room. For this reason, I feel the pellet boiler is a safer and more environmentally friendly system than gas.” According to the executing agency, after 2020, public institutions have increasingly faced financial constraints, due to the influence of COVID-19 in Moldova, and facilities tend to operate by giving more weight to cost advantage than environmental/social benefits. At facilities where both pellet and gas boilers are available for use, the latter tends to be prioritized, and one cannot exclude the possibility that the operation of pellet boilers depends on the trends of gas prices.

four perspectives.

Improving the Living and Learning Environment in Rural Communities

Before the implementation of this project, inefficient/non-practical means of heating[19] were observed in at least 7 sites. However, it was confirmed through the questionnaire and interviews with the executing agency and the rural sites (each target public facility) that the use of efficient and safe heating systems became possible by introducing pellet boilers through this project, and as a result, the learning environment has improved[20].

Diversifying Energy Sources

It was confirmed that the introduction of pellet boilers is contributing to the diversification of energy sources and is reducing the risk of dependence on imported energy in Moldova.

Greenhouse Gas (CO_2) Reduction

At the time of planning and based on the assumption that all 24 boilers would be operational, excluding one demonstration boiler, it was estimated that 5,629.2 tons of CO_2 emissions would be reduced annually. At the time of the ex-post evaluation, considering that only 9 of the 24 boilers are operational, the annual CO_2 emission reduction is estimated to be approximately 2,111 tons[21]. On the other hand, 11 sites are scheduled to become operational this winter (2021/2022), after which the annual CO_2 emission reduction is estimated to be approximately 4,691 tons[22] (more than 80% of the initial plan is expected to be achieved).

Awareness of Renewable Energy and Biomass

In the interviews with each target public facility, it was observed that they were familiar with the existence of renewable energy, the raw materials for biomass and how to use them. Specifically, those interviewed were aware of the situation and the risks of Moldova being over-dependent on gas, coal and oil, the existence of biomass as an abundant natural resource in the country and the fact that its utilization would be beneficial to the nation.

From the above, it can be said that this project is playing a role in improving the learning

[19] Wood-burning fireplaces, very expensive electricity, gas equipment from the 1970s and 1980s, aging coal heating, etc.

[20] In this evaluation study, interviews were conducted at the target sites of this project (sites in operation at the time of the ex-post evaluation: eight sites, total 14 people) to capture the following: “changes in knowledge and awareness regarding renewable energy and biomass utilization,” “changes in the spread and promotion of pellet production and pellet boilers in Moldova,” the “improvement status of living and learning environments in rural communities as a result of this project,” “ the negative impact on the natural environment, voices of residents regarding resettlement and land acquisition, etc.”

[21] The formula is 5,629.2 tons ÷ 24 × 9

[22] The formula is 5,629.2 tons ÷ 24 × 20

environment in rural areas, strengthening the energy supply system, raising awareness of renewable energy and biomass, and ultimately raising the environmental awareness of the residents.

3.3.2.2 Other Positive and Negative Impacts

1) Impact on the Natural Environment

This project was classified as Category C, as it did not fall under the vulnerable sectors/characteristics or vulnerable areas listed in *JICA's Guidelines for Environmental and Social Considerations* (promulgated in April 2010), and the undesired impact on the environment was judged to be minimal. In addition, according to Moldova's Environmental Impact Assessment (hereinafter referred to as "EIA") law and European Union standards, heat supply plants (or pellet boilers), with a calorific value of less than 300 MW, were not subject to EIA implementation and EIA was not required for this project.

Through the questionnaire and interviews with the executing agency and the target public facilities (9 sites) visited, it was confirmed that there was no particular impact on the natural environment (air pollution, noise/vibration, impact on the ecosystem, etc.) during project implementation and after completion. It was also confirmed that there were no claims or complaints regarding noise, vibration, etc. from the residents around the pellet boiler facilities.

The environmental monitoring of this project was the responsibility of the construction supervision consultant during the project implementation. After completion, it is carried out according to the law in Moldova; based on the Moldova Government Decree No. 548 and 549, the Environmental Protection Inspectorate and the Environmental Agency are responsible for environmental monitoring. Should there be any negative environmental impact (impact on the surrounding environment), it is the responsibility of the executing agency to report this immediately to both organizations. However, no serious incidences of this had been reported at the time of the ex-post evaluation.

2) Resettlement and Land Acquisition

It was confirmed through the questionnaire and interviews with the executing agency that there was no resettlement or land acquisition related to this project in any of the rural sites.

[Summary of Effectiveness and Impacts]

In Moldova, the natural gas price declined in 2018, and gas boilers become more cost effective

than biomass. For this reason, gas boilers tend to be prioritized at the time of the ex-post evaluation. While a total of 20 pellet boilers are planned to be operational this winter (2021/2022), only 9 boilers (9 sites) are operational at the time of the ex-post evaluation. As a result, it can be said that there are constraints with regard to reviewing the results of effectiveness/quantitative effects. However, 1) the reduction in heating costs exceeded the target and 2) job creation slightly underachieved the target. The project began on the assumption that dependence on pellet boilers would increase, due to soaring natural gas prices at the time of planning. At the target sites of this project, an environment was established in which a means of heating, cheaper than coal/wood/electricity, could be used during winter, without being influenced by the trends of imported energy prices. Although the reduction in greenhouse gas emissions (estimated value) is limited, the fact that the benefits of using renewable energy that makes effective use of agricultural waste is well known and promoted, and that it is also contributing to the country's energy security, demonstrates the impact is not necessarily low. Based on the above, 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 time of planning, the executing agency was the 2KR Project Implementation Unit (hereinafter referred to as "2KR-PIU") of the Ministry of Agriculture and Food Industry. However, based on the Government Decision No. 594 of July 2017, it was restructured and the Ministry of Agriculture, Regional Development and Environment[23] was created. Subsequently, the 2KR-PIU was reorganized as the Agency for Development and Modernization of Agriculture (ADMA), a governmental body, based on the Government Decision No. 536 of June 2020. Therefore, the executing agency at the time of the ex-post evaluation is ADMA. The staff engaged in the planning and implementation of this project at 2KR-PIU are not working in ADMA at the time of the ex-post evaluation.

It is the representative of the local authority (e.g., the mayor) that is responsible for the operation and maintenance of the facility and equipment, introduced at each target public facility (rural sites). On the other hand, as discussed in 3.2.1 Project Outputs under Efficiency, the NTC is responsible for the operation and maintenance of the demonstration pellet boiler and the pellet

[23] As supplementary information, the ministries and agencies were reorganized on August 12, 2021, and the Ministry of Agriculture, Regional Development and Environment was reorganized to become the Ministry of Agriculture and Food Industry.

plant at the time of the ex-post evaluation. Table 3 shows the organizational structure of each operation and maintenance.

Table 3: Organizational Structure of Each Operation and Maintenance at the Time of the Ex-Post Evaluation

	Pellet Boiler	Pellet Plant
Who is Responsible for the Operation and Maintenance	- 24 boilers: representative of the local authority (e.g., the mayor) - Demonstration boiler: NTC	- NTC
Who owns the Facility	- 24 boilers: each target public facility (facility manager, such as school director) - Demonstration boiler: NTC	- NTC
Who Actually Operates	- 24 boilers: operators hired by each target public facility - Demonstration boiler: operators of an organization, commissioned by NTC	- NTC
Who Bears the Cost of the Operation and Maintenance After Completion	- 24 boilers: budget of each target public facility - Demonstration boiler: NTC	- NTC

Source: answers to the questionnaire

At the time of the ex-post evaluation, 9 of the pellet boilers introduced by this project are operational. In this evaluation study, through the questionnaire with the executing agency, interviews at each target public facility and site visits, it was confirmed that the number of operators working at the sites where the boilers had been installed, was mostly sufficient. Operators are engaged in daily maintenance work, such as cleaning, inspection and maintenance, while technically specialized companies attend to more specialized maintenance work. As discussed in 3.3.1.1 Quantitative Effects under Effectiveness, preparations for operating the boilers, that were not yet operational at the time of the ex-post evaluation have been completed, including the inspection, operation structure and personnel aspect; operation of the boilers is planned to commence this winter (2021/2022).

With respect to the pellet plant, NTC, the owner of the plant, has not recruited any operation or maintenance staff. As discussed in 3.2.1 Project Outputs under Efficiency, this is because the budget required for operating the plant has not been secured. After the restructuring of Moldova's governmental organizations, the non-operational situation has not been resolved at the time of the ex-post evaluation. Although the NTC attempted to find a solution by collaborating with a private company, this did not materialize, as the plant has been constructed on a large scale and the cost

aspect was viewed as prohibitive[24].

Based on the above, it can be said that certain issues exist in relation to the institutional/organizational aspect of the operation and maintenance of this project.

Conversely, it was confirmed by the questionnaire and the interviews that the pellets used as fuel for the pellet boilers have no issues in terms of quality and that the supply system in Moldova is in place. According to the executing agency, pellets are sold at around 3,000 to 4,000 MDL per ton (around 19,800 to 26,400 yen), and these have been sold at a generally stable price over the last 4 to 5 years; moreover, there is no problem with the supply system. On the other hand, the natural gas in circulation is easily affected by international prices, and the possibility of soaring prices cannot be ruled out in the future. From that point of view, one can say that boilers fueled by pellets that can be procured domestically, the prices of which are relatively stable, are important as an alternative means of heating for gas boilers and are indispensable in terms of maintaining the heating supply system in the country. If the pellet plant becomes operational, the stability of the pellet supply system will increase, and its price may decrease further.

3.4.2 Technical Aspect of Operation and Maintenance

By the time this project was completed, the contractor had distributed 2 copies of the maintenance manual for pellet boilers to each target public facility, 3 copies to the executing agency and 5 copies to the pellet plant. The manual is used at each site as required for maintenance.

During the implementation of this project, operation and maintenance training (soft component training) was conducted at each target public facility when the pellet boiler was introduced. According to the executing agency, it was beneficial for each person to be involved in the preparation of the operation and to deepen their level of knowledge accordingly. At each facility where pellet boilers have been introduced, on-the-job training (OJT) related to the operation and maintenance work is conducted when new staff are hired.

Regarding the above, it is considered that there are no particular problems in relation to the technical aspects of the operation and maintenance of this project.

3.4.3 Financial Aspect of Operation and Maintenance

Table 4 shows the maintenance costs for the non-operating pellet plant and demonstration boiler.

[24] According to the NTC, it is difficult to solve this problem without instructions or budgetary measures from the Ministry of Agriculture, Regional Development and the Environment.

The expense is limited to maintenance, inspection and electricity bills, necessary to prevent the facilities from aging. The NTC allocates a budget and spends it every year. The electricity bill in 2020 decreased from the previous year, as the winter of 2020 was relatively warm.

Table 4: Maintenance Costs for the Pellet Plant and Demonstration Boiler

(Unit: MDL)

	2018	2019	2020
Raw Material	0	0	0
Marketing Cost	0	0	0
Salary/Labor	0	0	0
Electricity	22,469	25,468	14,128
Spare Parts	0	0	0
Maintenance Service	171,000	180,000	180,000

Source: document provided by the executing agency

Table 5 shows the maintenance cost of each target public facility that manages the pellet boiler (cost per boiler).

Table 5: Maintenance Cost of Each Pellet Boiler*Note

(Unit: MDL)

	2018	2019	2020
Pellet Purchasing Cost	30,000–135,370	30,000–115,571	30,000–78,036
Electricity	2,465–24,000	2,465–39,000	2,465–24,000
Maintenance (average)	500	800	1,300
Salary	15,126–16,930	14,981–17,038	13,170–19,248

Source: documents provided by the executing agency

Note: there is a range depending on the expense item. This is because the output was selected according to various conditions, such as the number of users in each facility and the floor area, and the boiler capacity differs accordingly.

Regarding each expense item, the executing agency commented, “the operation and maintenance costs required for the last 3 years may not be large, but we think we have secured the minimum necessary level.” The maintenance cost (average cost) exhibits an increasing trend towards 2020, but this amount is small compared to the overall maintenance cost. While there were 3 sites that did not spend maintenance costs, we confirmed that the minimum amount required for problems and their related repairs was spent. As previously mentioned, after 2020, COVID-19 caused financial concerns in Moldova, and the executing agency has suggested that it may not be easy to secure budgets in the future. Nevertheless, there are no particular concerns at the time of the ex-post evaluation.

Based on the above, there are no major concerns regarding the operation and maintenance costs of the facility and equipment currently in use. On the other hand, it will be necessary to monitor

the financial changes affected by COVID-19 in the future.

3.4.4 Status of Operation and Maintenance

Regarding the operating status of 9 pellet boilers, it was confirmed by the questionnaire and site inspections that there were no problems at the time of the ex-post evaluation. Some boilers experienced operational problems after the project was completed, however, quick fixes and repairs were carried out promptly. If necessary, facilities and equipment are repaired and replaced by specialized companies. Although the pellet plant is not in operation, maintenance and inspections are conducted to prevent aging.

Regarding spare parts, there are no cases where boilers are non-operational due to shortage of spare parts at the time of the ex-post evaluation. However, it is necessary to maintain a system that will enable smooth procurement in the future.

Therefore, it would appear that there are no particular problems as regards the operation and maintenance status of the pellet boilers in operation. At the same time, the pellet boilers that are scheduled to start operating from this winter (2021/2022) need thorough maintenance and inspections, as well as continuous operation checks to ensure a steady operation[25].

Some minor problems have been observed in terms of the institutional/organizational aspects. Therefore, sustainability of the project effects is fair.

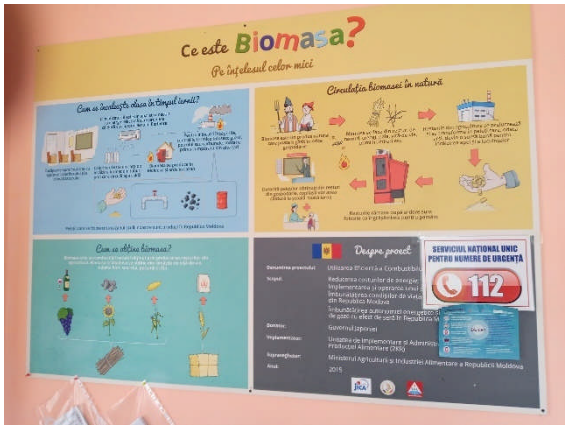

Photo 8: Poster regarding biomass fuel utilization (Kindergarten/culture facility in Branesti)

Photo 9: Stored pellet fuel (Vazaresti Kindergarten)

[25] It was confirmed via the questionnaire and interviews, held at the relevant public facilities, that the pellet boilers are maintained in such a way that they could be rolled out smoothly, should the need arise to switch from gas boilers.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to reduce energy cost and enable sustainable operation of heating facilities at public facilities (mainly education facilities such as primary schools) in Moldova by introducing pellet boilers and pellet plant, thereby contributing to the improvement in the living environment of the residents. The *Energy Strategy of the Republic of Moldova until 2020* and the *National Development Strategy Moldova 2030*, formulated by the government of Moldova, advocate improving energy utilization efficiency and reducing energy consumption through biomass fuel and renewable energy. They recognize biomass fuel as a beneficial alternative to natural gas and indispensable for the country's stable energy supply. The project is also in line with Japan's assistance policy and is therefore highly relevant. Regarding efficiency, although the output was generally as planned and the project cost was within the planned budget, the project period was slightly longer than planned as it took time to agree on the pellet boiler connection cost between the executing agency and some local target sites. Therefore, efficiency is fair. With regard to effectiveness, as a result of the decline in natural gas prices since 2018, gas heating tends to be prioritized in the country. As a result, only 9 of the 24 pellet boilers installed in rural areas are in operation at the time of ex-post evaluation. For this evaluation study, targets and actual results were available at 7 of the 9 operating sites; data required to analyze quantitative effects were limited. Keeping this in mind, 1) the heating cost reduction is above the target and 2) job creation was slightly below the target. On the other hand, a means of heating that is cheaper than coal, firewood and electricity, and safer and more environmentally friendly than natural gas, is secured, and heating can be used in winter regardless of the price trend of imported energy in the target areas of this project. The non-operational pellet boilers are scheduled to operate in the future, while the fact that renewable energy makes effective use of agricultural waste is widely known and promoted, and the project is contributing to the diversification of energy sources (energy security) in the country. Therefore, overall, the effectiveness and impacts are judged to be fair. Regarding sustainability, 9 operational pellet boilers have no breakage or malfunctions and 11 non-operational pellet boilers have been connected and are ready for operation from this winter (2021/2022). Thus, no problems are observed in the institutional, technical or financial aspects of operation and maintenance. However, there is no prospect for the operation and utilization of the pellet plant and the demonstration pellet boiler, and concerned parties need to discuss the solution. Therefore, the sustainability of the effects generated by this project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- In October 2016, the then Ministry of Agriculture and Food Industry transferred the ownership of the pellet plant from the executing agency, and as a result, NTC became responsible for the operation and maintenance of the introduced pellet plant and the demonstration pellet boiler. The facilities have not been made operational because there is no clear instruction or budget allocation from the Ministry of Agriculture, Regional Development and Environment, the upper supervisory authority. It is recommended that the executing agency, NTC and the Ministry of Agriculture, Regional Development and Environment discuss patiently and develop specific measures to be taken so that the facilities become operational. This is because the introduction and steady operation of these facilities will not only improve the heating environment but will also accelerate the effects of CO_2 reduction, diversification of energy sources and use of renewable energy.
- Regarding the 11 pellet boilers that are expected to become operational from this winter (2021/2022), it is recommended that the executing agency and the local sites responsible for operation and maintenance (each public facility) coordinate closely to ensure regular maintenance inspections are performed and the operation status is checked.
- At the time of the ex-post evaluation, gas boilers are in use at 4 sites, because gas boilers are more cost effective than pellet boilers. However, assuming that the price of natural gas may rise and the pellet boiler may have an advantage in the future, it is recommended that the executing agency and local sites (each public facility) make the necessary preparation so that the pellet boilers can be operational as soon as the need arises.

4.2.2 Recommendations to JICA

- With regard to the non-operating pellet plant and the pellet boilers that are expected to be operational in the future, JICA is advised to regularly check the situation with the executing agency and make a formal request as necessary, in order to prevent the loss of project benefits.

4.3 Lessons Learned

<u>Need for Clarification on Cost Bearings Regarding the Facility Operation and Consensus Building Between Both Parties</u>

- At 11 locations of the pellet boilers introduced, local sites (each public facility covered by this

project) refused to pay the incidental cost (mainly the cost related to the connection between the boiler and heat source facility). As a result, it took considerable time to coordinate and the project's progress was affected. This was because agreements were initially reached without clearly indicating the cost to be borne by each public facility. It was also affected by the fact that there was a system reform which changed the responsibilities of bearing the project fund in 2014, after this project began. The executing agency and the local sites should have clearly agreed on the approximate amount of cost to be borne and the project implementation schedule before the start of the project. For future similar projects, if there are multiple project sites and parties responsible for operation and maintenance, mutual understanding and clear agreements should be exchanged among the concerned parties. In case of system changes, a thorough measure such as reviewing the contents of the agreement and re-agreement should be taken promptly.

<u>Need to Minimize the Risk of Unused Facilities and Equipment Due to Changes in the Operation and Maintenance System</u>

- At the time of planning, the idea was to install a pellet plant on the premises of the executing agency and manufacture pellets that would be used as fuel by the pellet boilers to be installed. However, as discussed above, the responsibility for operation and maintenance changed from the executing agency to NTC. The budget required for operation has not been allocated and the facility has not been utilized until the time of the ex-post evaluation. For future similar projects, if it is anticipated that the introduced output may not be used, it is advisable that the assistance provider continues to collect information on a regular basis without waiting for a formal ex-post evaluation. At the same time, in the event of a major change in ownership or the operation and maintenance system of the introduced output, the recipient country should immediately notify the assistance provider of the change, even after the project is completed. It is desirable for both sides to work diligently to build such a system.