Indonesia

Ex-Post Evaluation of Japanese ODA Loan

"Decentralized Irrigation System Improvement Project in Eastern Region of Indonesia"

External Evaluator: Junko Fujiwara, OPMAC Corporation

0. Summary

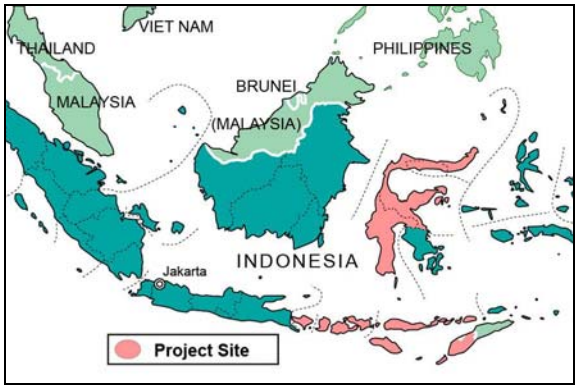
This project was intended to increase food production, mainly the rice crop, thereby contributing to poverty reduction in Eastern Indonesia through the new construction and rehabilitation of irrigation facilities and assistance for the institutional reinforcement of irrigation water management systems in the region.

This project was well in line with Japan's ODA policy as well as with Indonesian development policy and the development needs in the country such as correcting regional disparities, increasing food production and securing water resources. Therefore the project relevance is high. The effectiveness of this project is considered to be high, as there were tangible effects and the importance of irrigation facilities improved under the project; dual rice cropping during rainy seasons and planting in dry seasons were made possible in the Eastern region where water resources were scarce and where development projects were needed. A positive impact of the project, "contribution to poverty reduction in the project area", was confirmed and the high effectiveness of the project was apparent from the beneficiary survey. The effectiveness / impact of the project is deemed fair, as some information regarding environmental impacts and land acquisition was not available.

The efficiency of the project is fair as the project cost did not exceed the planned budget, but the project period was significantly longer than planned. In terms of maintenance and management of the project, there are minor problems in the technical and financial aspects and physical conditions of the facilities although there is no major issue with institutional aspect. Unless these problems are addressed comprehensively, it is likely that the current conditions of the facilities will worsen further. Therefore, sustainability of the project is fair.

In light of the above, the project is evaluated as partly satisfactory.

1. Project Description



Project Location

Constructed Weir of
Malaka Weir Irrigation Project

1.1 Background

In 1989, Japan signed a loan agreement for the "Small Scale Irrigation Management Project (1)" with the Government of Indonesia. With subsequent agreements for the "Small Scale Irrigation Management Project (2)" and the "Small Scale Irrigation Management Project (3)" signed in 1994 and 1997 respectively, the Japanese Government provided continued and long-term support for the building of irrigation facilities in eleven provinces in the Eastern part of Indonesia with a total irrigation coverage of 83,886 ha (accumulated) and a total canal length of 510 km. A series of these projects supported the Indonesian Government with various agricultural schemes including the introduction of high-yield species and the expansion of irrigated farmland in order to increase food production and to achieve self-sufficiency of rice supply. They also promoted improvement of the irrigation system in Eastern Indonesia for the reduction of disparities with other regions and of poverty.

The above three projects contributed to increased food production, including in the rice crop, and the development of farming infrastructure in poor areas of Indonesia. They also enabled decentralized provincial / district governments to enhance their project implementation capabilities and organizational structures for managing irrigation facilities. However, the demand-supply balance of rice remained unstable as the population increased at 1.6% annually while rice consumption increased at 3.1% annually. Combined with the slow growth in cultivated areas due to the decrease in farmland on Java Island, rice production was not able to catch up with the demand. To address the situation, the project was extended for the new construction and rehabilitation of irrigation facilities and for the provision of assistance to refine irrigation water management in eight provinces in Eastern Indonesia (Bali province, West Nusa Tenggara province, East Nusa Tenggara province and five provinces in the Sulawesi Island).

1.2 Project Outline

The objective of this project was to increase food production, mainly in the rice crop, by building and rehabilitating irrigation facilities and providing assistance for better irrigation water management in eight provinces in Eastern Indonesia thereby contributing to poverty reduction in the region.

Load Approved Amount / Disbursed Amount	27,035 million yen / 25,541 million yen
Exchange of Notes Date / Loan Agreement Signing Date	March 28, 2002 / October 10, 2002

Terms and Conditions	<Main portion> Interest Rate: 1.80%, Repayment Period: 30 years (Grace Period 10 years) , Conditions for Procurement: General untied <Consulting portion> Interest Rate: 0.75%, Repayment Period: 40 years (Grace Period 10 years), Conditions for Procurement: Bilateral tied
Borrower / Executing Agency	Government of Indonesia/Director General of Water Resources, Ministry of Public Works
Final Disbursement Date	February, 2012
Related Projects	Related Japanese ODA loans: ・"Small Scale Irrigation Management Project (1)" (L/A Signing: FY1989, Approved Amount: 1,896 million yen) ・"Small Scale Irrigation Management Project (2)" (L/A signing: FY1994, Approved Amount: 8,135 million yen) ・"Small Scale Irrigation Management Project (3)" (L/A signing: FY1997, Approved Amount: 16,701 million yen) ・"Decentralized Irrigation System Improvement Project in Eastern Region of Indonesia (II)" (L/A signing: FY2007, Approved Amount: 8,967 million yen)

2. Outline of the Evaluation Study

2.1 External Evaluator

Junko Fujiwara (OPMAC Corporation)

2.2 Duration of Evaluation Study

Ex-post evaluation of the project was conducted as below:

Duration of the Study: January 2014 - April 2015

Duration of the Field Study: April 6 - May 9, 2014, and August 6 -16, 2014

2.3 Constraints during the Evaluation Study

The ex-post evaluation was conducted, securing "possibility of evaluation" and excluding "selection bias in its survey" due to limitations related to (i) data and information collection and (ii) site survey and beneficiary surveys as follows.

2.3.1 Limitations related to data/information collection

The evaluation study could not cover the 40 out of 52 subprojects under the project for effective analysis as a comparison between the ex-ante and the ex-post status which secures the continuity of data for measuring effectiveness such as for irrigated areas predicted at the planning stage was difficult. This was because each of these subprojects, which had been supposed to be implemented as one subproject at the planning state, was eventually divided into several.

Among the 12 subprojects mentioned above, the questionnaires for Malaka Weir Irrigation, Ponre-Ponre Dam Irrigation and Paguyaman Weir Irrigation, which had been chosen for the mid-term review (conducted in FY 2007) and had been monitored as pilot projects for indicators in project effectiveness, were collected to ensure the possibility of evaluation. On the other hand, one subproject (Wae Dingin Irrigation: East Nusa Tenggara) for which questionnaire was collected, was not covered for the analysis due to the insufficiency of collected data. Questionnaires were not submitted in the remaining 8 subprojects.

2.3.2 Limitations in the Site Survey and Beneficiary Survey

In the evaluation study, site surveys and beneficiary surveys for all the 52 subprojects were not possible due to the limited timeframe, so some were selected from the total. In the course of selecting subprojects to be covered by the site survey and beneficiary survey, the following were included for the purpose of the exclusion of selection bias related to locational and climate factors as well as to the contents of subprojects: (i) the above 3 subprojects (Malaka, Ponre-Ponre and Paguyaman) which enabled effectiveness analysis, (ii) subprojects which contain various design elements such as new or rehabilitated, pond / weir / groundwater irrigations, and (iii) all the targeted 8 provinces as much as possible (including the major islands in East Nusa Tenggara province and West Nusa Tenggara province and a selection of locations which have different climates and different annual precipitations).

As a result, 6 provinces excluding Bali province and North Sulawesi province, namely East Nusa Tenggara province, South Sulawesi province, Gorontalo province, Southeast Sulawesi province, Central Sulawesi province and West Nusa Tenggara province were covered and 7 subprojects shown in Table 1 which includes those implemented on three major islands (Timor Island, Sumba Island, Sumbawa Island) in East and West Nusa Tenggara provinces were selected in the evaluation.

Table 1: Subprojects Selected for Site Surveys and Beneficiary Surveys

Subproject	Island	Province
Malaka Weir Irrigation Project	Timor	East Nusa Tenggara
Ponre-Ponre Dam Irrigation Project	Sulawesi	South Sulawesi
Paguyaman Weir Irrigation Project		Gorontalo
Benua Aporo Weir Irrigation Project		Southeast Sulawesi
Sausu Weir Irrigation Improvement Project		Central Sulawesi
Telaga Lebur Pond Irrigation Project	Lombok	West Nusa Tenggara
Kempo Groundwater Irrigation Project	Sumbawa	

Source: Developed by Evaluator
Note: Site surveys studied the current status of facilities management. Beneficiary interviews were conducted to evaluate project impact.

Based on the above, project effectiveness in the evaluation will be analyzed based on the Operation and Effect indicators for the above three pilot subprojects, and project impacts and sustainability will be analyzed based on conditions at the seven subprojects mentioned above, where observations on facility status through site surveys and detailed evaluation of survey responses were possible. This will constitute the overall evaluation of this project.

2.4 Remarks

The mid-term review was conducted in FY 2007 for this project. In the review, modification of the base / target figures at the time of appraisal was proposed for more realistic figures based on detailed design results conducted during the project implementation period (Table 2).

Table 2: Modified Operation and Effect Indicators

Subproject	Indicator	Figure	Original Figure	Modified Figure	Justification
Malaka Weir Irrigation	Rice cultivated area (rainy season)	Target Figure	10,000 ha	6,000 ha	At the time of project appraisal, the irrigated area was only a rough estimate. After the project started, more details on farmers' productivity and records on yield by crop per unit area became available.
Ponre-Ponre Dam Irrigation	Rice cultivated area (rainy season)	Base Figure	3,339 ha	2,400 ha	Based on re-evaluation of rain-fed area prior to the project
	Rice cultivated area (rainy season)	Target Figure	4,313 ha	3,749 ha	Reflecting detailed design results conducted upon the start of the project
	WUA formulation rate	Base Figure	41.67 %	N/A	According to the WUA formulation data approved by the district governor / court, officially organized Water Users Association (WUA) did not exist before the project. Therefor the base was modified to "Not Applicable".
Paguyaman Irrigation	Rice cultivated area (rainy season)	Base Figure	2,160 ha	2,090ha	Based on re-evaluation of rain-fed areas prior to the project
	Rice cultivated area (rainy season)	Target Figure	2,713 ha	6,880 ha	Reflecting the decision to expand the area through public consultation during the project implementation period
	Rice cultivated area (dry season)	Target Figure	2,713 ha	6,880 ha	
	WUA formulation rate	Base Figure	75 %	N/A	According to the WUA formulation data approved by the district governor / court, officially organized WUA did not exist before the project. Therefore the base was modified to "Not Applicable".

Source: Compiled by Evaluator based on periodical reports and mid-term review report

At the time of ex-post evaluation, however, official written agreement with the executing agency related to the modification was not found. It is not mentioned in progress reports nor in the project completion report. Except for the irrigated areas of each subproject, no indicator was monitored after mid-term review. Thus, the base / target figures modified at the time of the mid-term review are used as reference figures only, shown in project effectiveness in this ex-post evaluation report.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Plan of Indonesia

(1) National development plan level

At the time of appraisal (2002), "government decentralization and poverty reduction" was listed as one of the prioritized issues in the National 5-year Development Plan of Indonesia (Propenas 2000-2004). Also, under the "Development Program for Underdeveloped Regions", regional imbalance was pointed out as being a challenge for the irrigation sector, and, in particular, the development of water resources and irrigation facilities in the Eastern region was identified as a goal.

At the time of ex-post evaluation of this project, the National Long Term Development Plan (RPJPN) (2005-2025) and the second term National Medium Term Development Plan (PRJMN2) (2010-2014) were underway, and contribution to public welfare through economic development and achieving fair and equal development were listed as objectives. Also, "food security" (enhancing the competitiveness of agriculture products, increasing farmers' income levels, securing natural resources and the environment, building and maintaining irrigation infrastructure and facilities) was listed as a priority on the development agenda.

(2) Sector development plan level

At the time of project appraisal (2002), water resources and irrigation sector development plans ("food stability enhancement program", "water resource development and management program", etc.) were set forth responding to the National 5-year Development Plan (Propenas 2000-2004). The plan included improvement of the legal system for national policies for water resource development and management, the setting up of comprehensive organizations covering all the river basins together with financial system and regulations, the establishment of effective regulatory systems and implementation arrangements for better water quality and river basin water quality management.

At the time of ex-post evaluation, the 5-year Agriculture Development Plan (2009-2014), a sector development plan of the Ministry of Agriculture (MOA), listed four main goals: 1) Food

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

[2] ③: High, ②: Fair, and ①: Low

security with improved self-sufficiency in main staples 2) Diverse agricultural production to correct heavy reliance on rice 3) Highly competitive, value-added agricultural products to promote exports, and 4) Improvements in welfare for farmers.

3.1.2 Relevance to the Development Needs of Indonesia

At the time of appraisal (2002), Eastern Indonesia was still the least developed region. Per capita GDP remained at 70% of the national average, and the population living under poverty line was at 29.8% (2000) which shows a worse figure than the national average of 24.1% (2000). Further development was desperately needed in order to correct the regional disparities.

Farmland on Java Island, which had been a major rice producing area, was expected to decrease by 20,000 ha annually due to urbanization and industrialization in the area. Under these circumstances, increasing rice production in Eastern Indonesia, where 60% of the population farmed, was considered important to increase the overall rice production in Indonesia and to secure a stable supply of food. Development in agriculture was also expected to contribute to the correction of regional disparities. Thus the project was considered important from the perspectives of both poverty reduction and economic development.

At the time of the ex-post evaluation (2010), the population in the project target provinces living below the poverty line had mostly shrunk, particularly in the provinces with major cities and tourism destination such as Bali province (4.88%), North Sulawesi province (9.1%) and South Sulawesi province (11.6%). In Southeast Sulawesi province the number was (17.05%), in Central Sulawesi province (18.07%), West Nusa Tenggara province (21.44%), East Nusa Tenggara province (23.03%) and Gorontalo province (23.19%) the numbers were very poor, exceeding the national average (13.3%: 31.02 million people).

The population growth rate in the project target area was over 2% in Bali, East Nusa Tenggara, Southeast Sulawesi and Gorontalo, which is higher than the national rate. (1.49%: 2000-2010). The demand for rice as of 2013 was 4.3 million tons (14% of the whole nation). The demand was expected to grow in proportion to population growth, therefore the need for increased rice production continues to be high.

At the same time, water resources in Eastern Indonesia are scarce - only 13.5% of the total resources in the country (Table 3). In particular, West Nusa Tenggara and East Nusa Tenggara are dry regions and still have a high demand for irrigation facilities to a secure sufficient and continuous water supply throughout a year. However, according to the project execution agency, the implementation of irrigation facilities is still not easy as they are faced with difficulties in land acquisition and financial constraints.

Table 3: Available Water Resource in the Eastern Region (2013)

Unit: million m^3

Nation-wide	Eastern region	Sulawesi Island	Lesser Sunda Islands	Bali Island	Maluku Islands
3,906,500	525,500	299,200		49,600	176,700

Source: Questionnaire survey results
Note: "Lesser Sunda Islands" is a generic term for islands scattered in a wide range from Lombok Island to Timor Island. The area combines West Nusa Tenggara and East Nusa Tenggara provinces.

Further enhancement to increase rice production systems and to secure water resource is still therefore deemed necessary in the project area.

3.1.3 Relevance to Japan's ODA Policy

At the time of appraisal (2002), Country Assistance Policy for Indonesia (1994 - 2001) and the 2001 additional ODA policy recognized following urgent priority areas: 1) securing fairness, 2) human resources development and education, 3) securing the environment, 4) support for reorganization of industry structure, 5) building industry foundation (economic infrastructure), 6) support for stability of the macro economy, 7) support to promote various reformations and 8) the elimination of economic bottlenecks. The objective of this project, development in Eastern Indonesian (correction of regional disparities) and its overall goal, poverty reduction, apply to "securing fairness" mentioned above as priority area 1).

In addition, JICA's Medium-Term Strategy for Overseas Economic Cooperation Operations (2002) recognized agriculture / irrigation as one of the priority areas for Indonesia. This policy also supported the "transfer of responsibility for irrigation facilities maintenance to Water Users Association (WUA)" which was a condition for the World Bank's structural adjustment loans to water resource sectors. The project was in line with this policy.

To summarize, the project has been highly relevant to Indonesia's development plan and development needs in its Eastern region, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Effectiveness[3] (Rating: ②)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

Three subprojects (Malaka Irrigation Project, Ponre-Ponre Dam Irrigation Project, and Paguyaman Irrigation Project) were analyzed comparing the base figures (2001), target figures (2014) and actual figures at the mid-term review (2007) and ex-post evaluation (2013).

At the time of the ex-post evaluation, Operation and Effects indicators of the three subprojects either reached up to 80 to 90 % or exceeded the original target figures in rice cultivated area and yield by main crop per unit area. On the other hand, with all three

[3] Project impacts will also be taken into consideration when rating effectiveness

subprojects, the actual cultivated area used for produce other than rice did not reach the target. This may be due to the trend in the nine years of the project where rice became the main staple, causing a relative decrease in demand for produce other than rice.

As data on the net annual average farm income was not obtained[4], only that on gross, the latter instead of the former was analyzed comparing the base figures at the time of appraisal and the target figures, and it was found that Malaka and Ponre-Ponre exceeded the original target figures.

Taking into consideration that the intended project outcome is to contribute to "increased food production mainly in rice", the project effectiveness is judged in a comprehensive way which not only focuses on annual rice cultivated area and unit yield of major crops but also considers indicators such as the gross annual average farm income as reference.

Although the WUA formulation rate was also listed as an Operation and Effects indicator, this indicator shows a project output rather than effectiveness of the project. The effect of this indicator would be an improved management structure. Therefore this aspect will be analyzed in detail under "sustainability".

Analysis results for the three subprojects are described separately below:

(1) Malaka Weir Irrigation Project (Table 4)

Looking at the shift in figures for Operation and Effect indicators, the steady increase in rice cultivated area and its unit yield is significant. The rice cultivated area remains less than 60% of the target for the rainy season, but for the dry season it increased significantly as a result of securing water resources. As a result, the total annual cultivated area at the time of the ex-post evaluation has reached over 80 % of the original target. According to the River Basin Management Office ("Balai Office"), before project implementation farmers planted rice, maize and peanuts only once in the rainy season and consumed maize and peanuts as daily staples. Rice consumption was limited to about once a week and special occasions such as weddings and funerals. After project implementation, rice planting was possible twice a year - one in the rainy season and again in the dry season. Also, they moved to wet-rice planting from dry planting, securing enough supply for the demand for rice as the main source of food.

On the other hand, actual figures for cultivated areas for maize, mung beans and peanuts ended up far from the targets. This can be largely attributed to a shift in food preference from maize to rice causing a relative decrease in demand for produce other than rice.

Looking at the unit yield by crop, all produce exceeded their targets. A significant improvement is also seen in the gross annual average farm income. It is likely that farmers benefited largely form the ability to plant rice in the dry season.

[4] It is considered difficult to obtain data on net annual average farm income as it is calculated by deducting farm management expenditure from gross farm income.

The WUA formulation rate remained at 45 % against the target of 100%. This is because the organization of WUA has taken longer than expected.

Table 4: Shift in Operation and Effect Indicators (Malaka Weir Irrigation Project)

Indicator		Base Year (2001)	Target set at Project Appraisal	Target modified at Mid-term Review (reference)		Actual at Mid-term Review (2007)	Actual at Ex-post Evaluation (2013: one year after project completion)
				Base Figure	Target Figure (2014: 2 years after project completion)		
Cultivated area by crop (ha)							
	Rice (rainy season)	2,146	10,000	No change	6,000	2,300	5,716
	Rice (dry season)	406	2,667	No change	No change	1,430	4,371
	Maize	N/A	2,333	No change	No change	Rainy season 2,170 Dry season 1,180	672
	Mung beans	N/A	2,000	No change	No change	768	285
	Peanuts	N/A	2,500	No change	No change	N/A	60
WUA formulation rate (%)		33.33	100	No change	No change	83.9	45
Unit Yield by crop (ton/ha)							
	Rice (rainy season)	2.3	2.5	No change	No change	3.0	4.3
	Rice (dry season)	2.3	2.6	No change	No change	3.0	3.4
	Maize	N/A	2.2	No change	No change	Rainy season 1.6 Dry season 1.2	2.6
	Mung beans	N/A	0.84	No change	No change	0.87	1.2
	Peanuts	N/A	1.3	No change	No change	N/A	1.6
Gross Annual Average Farm Income (1,000 Rp./year)		2,057	13,855	-	-	-	25,800
Net Annual Average Farm Income (1,000 Rp./year)		822	7,377	No change	No change	N/A	N/A

Source: Questionnaire survey results

Note: The definitions of each indicator are as follow. Cultivated area indicates total annual area of cultivation within the benefited area. WUA formulation rate is calculated by dividing the number of WUA formed by the number of tertiary canal blocks. Assuming that one WUA is formed per one block of tertiary canal. Unit yield by crop indicates the yield per unit area by crop. Cropping intensity indicates how many times a crop is planted per year. For example, if rice is planted twice a year it is 200%. Gross annual average farm income indicates crop production volume multiplied by crop price. Net annual average farm income = gross annual average farm income – (total production cost – family labor cost – own land cost – equity interest).

(2) Ponre-Ponre Dam Irrigation Project (Table 5)

Comparing the target figures to the actuals at the time of the ex-post evaluation, the area for rice cultivation exceeded the target in the rainy season but not in the dry season. Combined cultivated area for both seasons almost reached the total target figure. According to the Balai Office, farmers used to plant rice only once in the rainy season before project implementation, but after the project it became possible to plant in the dry season as well although it was only half of what was possible in the rainy season. The cultivated area of peanut reached 90% of the target. On the other hand, the actuals for the cultivated area for maize and mung beans, which

were consumed as alternative staples when rice planting was limited to the rainy season, were far below the targets. This may be explained by the fact that crops such as maize require less water and that they need water management / adjustment that is different from rice farming, as well as by the background fact that rice is becoming more important as the main source of food.

As for the yield per unit area, each product reached the target with rice and maize far exceeding their targets.

Although WUAs were more enhanced in Ponre-Ponre, the WUA formulation halted when the coverage exceeded 1,000 ha partly due to the regulation change that transferred the responsibility for supervision of WUA from the Ministry of Public Works (MOPW) to the MOA. In addition, Farmers' Associations (managed under the MOA as WUAs) were gaining higher positions relative to WUAs, which resulted in the low WUA formulation rate, at 23%.

Gross annual average farm income exceeded the target significantly. This can be mainly attributed to the fact that rice planting in the dry season was made possible and increased yield from each crop resulted in a larger volume of production.

Table 5: Shift in Operation and Effect Indicators (Ponre-Ponre Dam Irrigation Project)

Indicator		Base Year (2001)	Target set at Project Appraisal	Target modified at Mid-term Review (reference)		Actual at Mid-term Review (2007)	Actual at Ex-post Evaluation (2013: one year after project completion)
				Base Figure	Target Figure (2014: 2 years after project completion)		
Cultivated area by crop (ha)							
	Rice (rainy season)	3,339	4,313	2,400	3,749	3,000	4,331
	Rice (dry season)	N/A	2,157	No change	No change	N/A	1,500
	Maize	N/A	2,157	No change	No change	500	600
	Mung beans	266	1,294	No change	No change	N/A	70
	Peanuts	381	2,157	No change	No change	1,000	2,000
WUA formulation rate (%)		41.67	100	N/A	No change	15.6	23
Unit Yield by crop (ton/ha)							
	Rice (rainy season)	2.0	3.5	No change	No change	3.0	5.2
	Rice (dry season)	3.2	3.5	No change	No change	N/A	4.8
	Maize	N/A	2.0	No change	No change	1.0	5.0
	Mung beans	0.25	1.2	No change	No change	N/A	1.4
	Peanuts	0.35	1.4	No change	No change	1.0	1.4
Gross Annual Average Farm Income (1,000 Rp./ year)		1,624	9,157	-	-	-	15,500
Net Annual Average Farm Income (1,000 Rp./year)		871	5,193	No change	No change	3,326	N/A

Source: JICA internal information, mid-term review report, and questionnaire survey results

Note: The definitions of each indicator are as follows. Cultivated area indicates the total annual area of cultivation within the benefited area. WUA formulation rate is calculated by dividing the number of WUA formed by the number of tertiary canal blocks. Assuming that one WUA is formed per one block of tertiary canal. Unit yield by crop indicates the yield per unit area by crop. Cropping intensity indicates how many times crop is planted per year. For example, if rice is planted twice a year it is 200%. Gross annual average farm income indicates crop production volume multiplied by crop price. Net annual average farm income = gross annual average farm income – (total production cost – family labor cost – own land cost – equity interest).

Note: Photo taken on May, 2014

Photo 1: Ponre-Ponre Irrigation Dam

Note: Photo taken on May, 2014

Photo 2: Irrigated Farmland in Ponre-Ponre

(3) Paguyaman Irrigation Project (Table 6)

Rice cultivated areas, particularly in the dry season, were increased significantly as a result of securing water resources, and the areas of both the dry and rainy seasons exceeded the actual figures at the time of the mid-term review as well as the target figures at the time of the appraisal. However, the expected amount of water did not reach marginal facilities in a stable manner and some farmers chose to grow sugar cane, renting their land to businesses.

On the other hand, the unit yield of rice exceeded the targets significantly. It is difficult to measure the effectiveness for maize, mung beans and peanuts as their target figures were not determined.

WUA activities remained at 40% at the time of ex-post evaluation, far from the target (100%). These existing associations showed active engagement such as hosting regular meetings, and farmers were showing improvement in performing planned tasks based on the rice planting calendar provided by the local Department of Agriculture (DOA). However, it has been only three years since the organization of WUA and more skills and accumulation of experience is necessary.

The gross annual average farm income was far below the target. A relation between the steady increase in cultivated areas as well as in the yield, mainly for rice, and the contribution of the project to poverty reduction was not found[5].

[5] It can be assumed that the gross annual average farm income was supposed to be on an upward trend due to improvements in the rice cultivated area and unit yield, but it was not possible to confirm this from the answers of the executing agency. A possible reason may be the low reliability of data on the gross annual average farm income or the influence caused by the bad harvests of other crops (for the latter, judgment is difficult as no data related to each index of other crops was obtained from the time of project appraisal).

Table 6: Shift in Operation and Effect Indicators (Paguyaman Irrigation Project)

Indicator		Base Year (2001)	Target set at Project Appraisal	Target modified at Mid-term Review (reference)		Actual at Mid-term Review (2007)	Actual at Ex-post Evaluation (2013: one year after project completion)
				Base Figure	Target Figure (2014: 2 years after project completion)		
Cultivated area by crop (ha)							
	Rice (rainy season)	2,160	2,713	2,090	6,880	3,529	5,774
	Rice (dry season)	N/A	2,713	No change	6,880	512	5,774
	Maize	188	N/A	No change	No change	1,942	1,105
	Mung beans	N/A	N/A	No change	No change	N/A	N/A
	Peanuts	N/A	N/A	No change	No change	N/A	N/A
WUA formulation rate (%)		75	100	N/A	No change	0	40
Unit Yield by crop (ton/ha)							
	Rice (rainy season)	3.0	4.4	No change	No change	3.5-4.0	5.5
	Rice (dry season)	N/A	4.6	No change	No change	N/A	5.7
	Maize	1.0	N/A	No change	No change	3.0	4.2
	Mung beans	N/A	N/A	No change	No change	N/A	0.9
	Peanuts	N/A	N/A	No change	No change	N/A	1.1
Gross Annual Average Farm Income (1,000 Rp./year)		3,156	11,602	-	-	-	6,870
Net Annual Average Farm Income (1,000 Rp./year)		1,024	3,044	No change	No change	6,452	N/A

Source: JICA internal information, mid-term review report, and questionnaire survey results
Note: The definitions of each indicator are as follows. Cultivated area indicates the total annual area of cultivation within the benefited area. WUA formulation rate is calculated by dividing the number of WUA formed by the number of tertiary canal blocks. Assuming that one WUA is formed per one block of tertiary canal. Unit yield by crop indicates the yield per unit area by crop. Cropping intensity indicates how many times crop is planted per year. For example, if rice is planted twice a year it is 200%. Gross annual average farm income indicates crop production volume multiplied by crop price. Net annual average farm income = gross annual average farm income – (total production cost – family labor cost – own land cost – equity interest).

3.2.2 Qualitative Effects

Beneficiary surveys were conducted at seven sites in six provinces including the Malaka Weir Irrigation Project, Ponre-Ponre Dam Irrigation Project and Paguyaman Weir Irrigation Project. See Table 7 for the overview of survey respondents[6]. All of the respondents were the heads of households, and the average age was 41.3. A breakdown of respondents by upper

[6] Survey target: Beneficiary farmers extraction method: Through the MOPW Balai Office who executed each subproject, respondents were selected mainly from WUA members by river stream areas (upper, middle, lower streams). Survey method: Structural questionnaire (Face-to-face interview). Location and dates are as follows: Malaka: Central Malaka Sub-district, West Malaka Sub-district, Kobalima Sub-district and Weliman Sub-district of Malaka District, East Nusa Tenggara Province (3 May 2014), Ponre-ponre: Libureng Sub-district, Kahu Sub-district of Bone District, South Sulawesi Province (20 May 2014), Paguyaman: Tolango Hula Sub-district, Asparaga Sub-district, Wonosari Sub-district and Boliyohuto Sub-district of Gorontalo District, Gorontalo Province (28 and 29 April 2014), Benua Aporo: Basalah Sub-district of South Konawe District, Southeast Sulawesi Province (16 and 17 May 2014), Sausu: Balinggi Sub-district, Torue Sub-district of Parigi Moutong District, Central Sulawesi Province (14 May 2014), Telaga Lebur: Sekotong Sub-district of West Lombok District, West Nusa Tenggara Province (3 June 2014), Kempo: Kempo Sub-district, Manggilewa Sub-district of Dompu District, West Nusa Tenggara Province (30 May 2014).

stream, middle stream and lower stream cultivated areas is 75, 50 and 95 respectively. Of the 220 households, 139 were WUA members and 123 participate in WUA activities.

Table 7: Overview of Beneficiary Survey Respondents

Unit: person

Subproject	Number of Respondents (household)	Average Age of Household Head	Farming Location			Memberships of WUA	
			Upper stream	Mid-stream	Lower stream	No of members (members / total respondents)	No of active members (active members / total members)
Malaka Weir Irrigation	35	40.4	4	16	15	23 (65.7%)	13 (56.5%)
Ponre-Ponre Dam Irrigation	30	41.4	14	9	7	30 (100%)	30 (100%)
Paguyaman Weir Irrigation	33	46.1	11	13	9	32 (97.0%)	26 (81.3%)
(1) 3 pilot projects subtotal	98		29	38	31	85 (86.7%)	69 (81.2%)
Benua Aporo Weir Irrigation	31	40.0	0	2	29	0 (0%)	N/A
Sausu Weir Irrigation	29	43.0	8	10	11	23 (79.3%)	23 (100%)
Telaga Lebur Pond Irrigation	31	41.8	21	0	10	0 (0%)	N/A
Kempo Groundwater Irrigation	31	36.1	17	0	14	31 (100%)	31 (100%)
(2) Subtotal of remaining 4 (non-pilot)	152		46	12	64	54 (35.5%)	54 (100.0%)
(3) Total (1)+(2)	220	41.3	75	50	95	139 (63.2%)	123 (88.5%)

Source: Beneficiary survey results

The beneficiary survey results are summarized below in “changes in farming water supply”, “changes in rice yield” and “current status of rice farming”. The survey results from seven locations showed improvement in the farming water supply, improved rice yield and increased rice cultivations, thereby indicating the high effectiveness of the project was not limited to the three pilot projects.

(1) Changes in farming water supply

Approximately 70% of all respondents (152) answered that “rehabilitated / newly built irrigation facilities improved the water supply to farmland”. By subproject, the numbers were high at Malaka (85.7%), Kempo (80.6%), and Ponre-Ponre (76.7%) and in the mid-stream area (80.0%) by location.

On the other hand, the numbers of respondents who answered “Water supply is same as before project” were high at Benua Aporo (32.3%), Paguyaman (24.2%), Sausu (24.1%) and in the lower stream area (23.2%). Water gate operations and water distribution monitoring are mainly done by residents under the directions of the Balai Office or the local Department of

Water Resources (DOWR), and improvement in operation skills and maintenance activities is required in order to ensure sufficient water distribution to lower stream areas.

Table 8: Changes in Water Supply to Farmland

Unit: person

By Subproject / by Farming Location	Answer				Total
	Increased / improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Total	152 (69.1%)	40 (18.2%)	21 (9.5%)	7 (3.2%)	220
Breakdown by Subproject					
Malaka Weir Irrigation	30 (85.7%)	2 (5.7%)	3 (8.6%)	0 (0.0%)	35
Ponre-Ponre Dam Irrigation	23 (76.7%)	4 (13.3%)	2 (6.7%)	1 (3.3%)	30
Paguyaman Weir Irrigation	19 (57.6%)	8 (24.2%)	5 (15.2%)	1 (3.0%)	33
Benua Aporo Weir Irrigation	17 (54.8%)	10 (32.3%)	4 (12.9%)	0 (0.0%)	31
Sausu Weir Irrigation	19 (65.5%)	7 (24.1%)	2 (6.9%)	1 (3.4%)	29
Telaga Lebur Pond Irrigation	19 (61.3%)	4 (12.9%)	4 (12.9%)	4 (12.9%)	31
Kempo Groundwater Irrigation	25 (80.6%)	5 (16.1%)	1 (3.2%)	0 (0.0%)	31
Breakdown by Farming Location					
Upper stream	54 (72.0%)	13 (17.3%)	6 (8.0%)	2 (2.7%)	75
Mid stream	40 (80.0%)	5 (10.0%)	3 (6.0%)	2 (4.0%)	50
Lower stream	58 (61.1%)	22 (23.2%)	12 (12.6%)	3 (3.2%)	95

Source: Beneficiary survey results

(2) Changes in rice yield

Looking at how farming may have improved (Table 9), over 70% of all respondents (157) indicated that “rice yield increased”. This tendency is significant at Ponre-Ponre Dam Irrigation Project (96.7%), Paguyaman Weir Irrigation Project (84.4%), Kempo Groundwater Irrigation Project (74.2%), Malaka Weir Irrigation Project (71.4%) and in the middle stream area (80.0%) and the upper stream area (78.7%). According to the Balai Office, in Kempo, farmers were able to plant in dry seasons after the project. In the Telaga Lebur Pond Irrigation Project area, dual cropping of rice was made possible, and the unit yield of rice as well as secondary produce increased. On the other hand, in the Benua Aporo and Sausu irrigation project areas, respondents who indicated “no change after project” or “decreased/aggravated after project” were approximately 20%, which is not low. This indicates that there is room for improvement in water supply management for more optimal timing and amounts.

121 farmers out of 220 checked both “increased rice yield” and “increased farming water supply” indicating that there is a strong correlation between these two. The project enabled farmers to secure sufficient water during the planting time and dry seasons, which appears to have been highly effective for rice farming.

Table 9: Changes in the Unit Yield of Rice

Unit: person

By Subproject / by Farming Location	Answer				Total
	Increased / improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Total	157(71.4%)	40 (18.2%)	15 (6.8%)	8 (3.6%)	220
Of whom the number of beneficiaries who also stated their farm water supply increased	121	24	12	0	157
Breakdown by Subproject					
Malaka Weir Irrigation	25 (71.4%)	9 (25.7%)	0 (0.0%)	1 (2.9%)	35
Ponre-Ponre Dam Irrigation	29 (96.7%)	1 (3.3%)	0 (0.0%)	0 (0.0%)	30
Paguyaman Weir Irrigation	28 (84.8%)	2 (6.1%)	3 (9.1%)	0 (0.0%)	33
Benua Aporo Weir Irrigation	15 (48.4%)	6 (19.4%)	6 (19.4%)	4 (12.9%)	31
Sausu Weir Irrigation	16 (55.2%)	7 (24.1%)	6 (20.7%)	0 (0.0%)	29
Telaga Lebur Pond Irrigation	21 (67.7%)	7 (22.6%)	0 (0.0%)	3 (9.7%)	31
Kempo Groundwater Irrigation	23 (74.2%)	8 (25.8%)	0 (0.0%)	0 (0.0%)	31
Breakdown by Farming Location					
Upper stream	59 (78.7%)	12 (16.0%)	2 (2.7%)	2 (2.7%)	75
Mid stream	40 (80.0%)	6 (12.0%)	4 (8.0%)	0 (0.0%)	50
Lower stream	58 (61.1%)	22 (23.2%)	9 (9.5%)	6 (6.3%)	95

Source: Beneficiary survey results

(3) Current status of rice farming

Table 10 shows the current status of rice farming with the 220 beneficiary farmers by season and stream area. About 70% farmers (161) plant rice twice a year, and especially Malaka Weir Irrigation Project, Ponre-Ponre Dam Irrigation Project, Benua Aporo Weir Irrigation Project and Sausu Weir Irrigation Project show high dual-cropping rates at approximately 90 to 100 %. Also, the dual cropping rate is high in the middle stream area (just under 90 %, 46 out of 50). Dual cropping at the Paguyaman Weir Project is just under 70% (22), but the remaining 30 % or so responded either “plant three times” or “plant four times” indicating that all of the respondents plant at least once in dry season and that the rice planting rate is going up as well. At Kempo Groundwater Irrigation Project, 28 farmers (over 90%) answered that they planted once (rainy season only), but 19 of them indicated that the rice yield increased after the project. That gives the implication that even when they only “planted once” there had been some improvement in place.

Looking at the correlation between the number of plantings and how the rice yield performed, farmers who planted either “three times a year” or “four times a year” all indicated that their “rice yield increased”, so the increase in the number of plantings including during dry seasons can be attributed to the project implementation. In addition, 71.4% of the farmers who “planted twice a year”, and 76.3% who “planted once a year” answered that their “rice yield increased” indicating that the project effectiveness is recognized by a large number of beneficiaries.

Table 10: Changes in the Number of Rice Plantings

Unit: person

By Subproject / by Farming Location	No of Crop: 0 time	No of Crop: 1 time	No of Crop: 2 times		No of Crop: 3 times		No of Crop: 4 times	Total
	rainy season: 0 dry season: 0	rainy season: 1 dry season: 0	rainy season: 2 dry season: 0	rainy season: 1 dry season: 1	rainy season: 2 dry season: 1	rainy season: 1 dry season: 2	rainy season: 2 dry season:2	
Total	8 (3.6%)	38 (17.3%)	25 (11.4%)	136 (61.8%)	4 (1.8%)	2 (0.9%)	7 (3.2%)	220
Of whom the number of beneficiaries who also stated their unit yield of rice increased	0	29	21	94	4	2	7	157
Breakdown by subproject								
Malaka Weir Irrigation	1 (2.9%)	0 (0.0%)	2 (5.7%)	32 (91.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	35
Ponre-Ponre Dam Irrigation	0 (0.0%)	3 (10.0%)	15 (50.0%)	12 (40.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	30
Paguyaman Weir Irrigation	0 (0.0%)	0 (0.0%)	0 (0.0%)	22 (66.7%)	4 (12.1%)	0 (0.0%)	7 (21.2%)	33
Benua Aporo Weir Irrigation	4 (12.9%)	0 (0.0%)	0 (0.0%)	27 (87.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	31
Sausu Weir Irrigation	0 (0.0%)	0 (0.0%)	0 (0.0%)	29 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	29
Telaga Lebur Pond Irrigation	3 (9.7%)	7 (22.6%)	5 (16.1%)	14 (45.2%)	0 (0.0%)	2 (6.5%)	0 (0.0%)	31
Kempo Groundwater Irrigation	0 (0.0%)	28 (90.3%)	3 (9.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	31
Breakdown by Farming Location								
Upper stream	2 (2.7%)	17 (22.7%)	12 (16.0%)	36 (48.0%)	3 (4.0%)	2 (2.7%)	3 (4.0%)	75
Mid stream	0 (0.0%)	0 (0.0%)	6 (12.0%)	40 (80.0%)	1 (2.0%)	0 (0.0%)	3 (6.0%)	50
Lower stream	6 (6.3%)	21 (22.1%)	7 (7.4%)	60 (63.2%)	0 (0.0%)	0 (0.0%)	1 (1.1%)	95

Source: Beneficiary survey results
Note: Beneficiary farmers who grow rice in dry seasons also grow rice in rainy seasons

In summary, irrigation facilities provided through the project enabled dual cropping and dry season planting in Eastern Indonesia where water resources were scarce and various development efforts are still required. The effect and importance of the project are mostly apparent in both qualitative and quantitative analyses. Therefore, it is determined that the objective of the project, “Increase food production mainly in rice” has been achieved. Thus the effectiveness of the project is high.

3.3 Impact

3.3.1 Intended Impacts

(1) Household finances

In the beneficiary survey on farming income, 164 farmers (74.5%) answered that their income “increased after the project”. According to related information provided by the Balai

Office, in post-project Ponre-Ponre, the financial situation of beneficiary farmers improved due to the increased farming income; houses were renovated, and migrating workers to overseas (to countries like Malaysia) also decreased. Similarly, household income increased in the Paguyaman Irrigation Project area, where farmers were able to afford vehicles, improve children's schooling and renovated their houses as well. In Kempo, planting in both seasons made farmers be more economically wealthy, and many households are now able to afford motorbikes.

As for farming expenses, 187 farmers (85.0%) answered that the expenses "increased after the project". Some of these expenses were used to secure additional labor and to purchase seedlings and chemicals. 94 beneficiaries (42.7%) answered that they needed a larger labor force after the project indicating that they were responding to increased yield amount. On the other hand, 87 respondents (39.5%) maintained the "same labor force as before the project" indicating that they either 1) continued to use the same farming method regardless of the changes in yield per unit area or 2) achieved more efficient farming using agricultural machinery[7].

100 farmers (45.5%) responded that their "non-farming expenses increased" showing a trend that expenses are on the rise regardless of their being farming or non-farming related. As for savings, 73 respondents (33.2%) answered that they "increased after the project", but 47 respondents (21.4%) said that they remained the "same as before the project". That implies that livestock such as farm animals are raising the number for "Other / Not Applicable" (91 respondents (41.4%)).

Table 11: Household Finances

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others/ N/A	
Household farm income	164 (74.5%)	36 (16.4%)	19 (8.6%)	1 (0.5%)	220
Farm labor	94 (42.7%)	87 (39.5%)	2 (0.9%)	37 (16.8%)	220
Farm expenses	187 (85.0%)	26 (11.8%)	6 (2.7%)	1 (0.5%)	220
Job opportunities for family members	66 (30.0%)	61 (27.7%)	10 (4.5%)	83 (37.7%)	220
Household Non-farm Income	45 (20.5%)	64 (29.1%)	11 (5.0%)	100 (45.5%)	220
Household Non-farming Expenditure	100 (45.5%)	33 (15.0%)	8 (3.6%)	79 (35.9%)	220
Savings	73 (33.2%)	47 (21.4%)	9 (4.1%)	91 (41.4%)	220

Source: Beneficiary survey results

Note: For "Job opportunities for family members" and "non-farming income", 30% to 50% answered "Other / Not applicable". This is because not many beneficiaries engage in occupations other than farming, so it is difficult to compare with the situation pre-project.

[7] For example, in Sausu, farmland per household is as large as 10 ha, so each household uses farm machines.

(2) Improvement in life infrastructure

In the beneficiary survey, 157 farmers (71.4%) answered that the quality of water used for farming and households was improved by the project irrigation facilities. The water supplied through the canals is used not only for farmland but also for people's daily lives (such as laundry and bathing). With rehabilitations and new construction of canals, water became cleaner as impurities were removed from water regularly. Farmers seemed to feel the effect of well-maintained irrigation systems and the outcome of their maintenance activities.

Note: Photo taken in May, 2014

Photo 3: Tertiary Canal in Malaka Weir Irrigation Facilities

Water supply to residences was not an objective of this project. Combined with the fact that residents face serious conditions unique to dry regions where they need to rely largely on rain water, responses to "Water supply to household" were "same as before project" for 115 farmers (52.3%) and "Other / Not applicable" for 44 farmers (20.0%). On the other hand, 57 farmers (25.9%) answered that the water supply to household "increased after the project". Since water is available for laundry and other daily necessities if a resident goes to a canal or another irrigation facility, the need for water for daily use is satisfied to some extent and people enjoy additional positive effects brought by the project as well.

A more significant contribution to residents' living environment is seen in improved road conditions along the canal facilities. This contribution is indicated in the beneficiary responses where 115 beneficiaries (52.3%) answered that road access improved around the irrigation facilities. This implies that surrounding road improvement that comes with canal development has contributed to improvement in the living environment of beneficiaries.

Table 12: Improvement in Life Infrastructure

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others/ N/A	
Water Quality	157 (71.4%)	34 (15.5%)	24 (10.9%)	5 (2.3%)	220
Water Supply to Household	57 (25.9%)	115 (52.3%)	4 (1.8%)	44 (20.0%)	220
Road Access	115 (52.3%)	68 (30.9%)	32 (14.5%)	5 (2.3%)	220

Source: Beneficiary survey results

Note: Beneficiaries' answers to the condition of the water supply to households implies mainly water for general purposes (laundry, swimming and such).

(3) Improvement in health, hygiene and education

In the beneficiary survey, 137 farmers (62.3%) answered that "health and hygiene improved". Also, 128 farmers (58.2%) answered that "children's education opportunities increased". Expenses for health and education add up as they include medical supplies, clothing, transportation costs to go to school and healthcare facilities. Increased income achieved through the project appears to make these expenses more affordable contributing to a better quality of life.

Table 13: Improvement in Health, Hygiene and the Education Environment

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others/ N/A	
Health and Hygiene of Household	137 (62.3%)	58 (26.4%)	16 (7.3%)	9 (4.1%)	220
EducationLlevel for Children	128 (58.2%)	49 (22.3%)	2 (0.9%)	41 (18.6%)	220

Source: Beneficiary survey results

(4) Diversity in local market and businesses

In the beneficiary survey, 131 farmers (59.5%) out of the total 220 answered that "the local market became more active after the project". It is conceivable that the project contributed to increased yield in rice and other crops and that farmers started selling the surplus at the local market.

As for "diversity in local businesses", 74 farmers (33.6%) answered that they "diversified", and 123 farmers (55.9%) answered "same as before project". Poverty rates in the project areas were high and it is possible that any increase in yield was directed to the farmers' own consumption as they had been faced with challenges in rice production and consumption. It is not confirmed yet whether there is any trend where a surplus in crops is invested in the manufacture of processed agricultural products for new business development. A significant shift in farmers' attitude and mindset toward businesses would be required. Therefore, it is advisable to monitor local trends at an ongoing basis.

Table 14: Diversity in Local Market and Businesses

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others/ N/A	
Local Markets	131 (59.5%)	60 (27.3%)	25 (11.4%)	4 (1.8%)	220
Diversity of Local Businesses	74 (33.6%)	123 (55.9%)	17 (7.7%)	6 (2.7%)	220

Source: Beneficiary survey results

In summary, post-project improvement is recognized in farming income and farmers' savings to secure a cash surplus, which suggests effectiveness of the project. As for the life infrastructure, improvement in water quality and road access seems to contribute to an overall betterment of residents' living environment indicating indirect effectiveness of the project. In addition, the health, hygiene, and education of residents are mostly improving. While local markets are becoming more active, signs of business investment and new business development, which would require specific technology and skills, are yet to be seen. Although a short-term, rapid income increase is not expected, it is apparent that the beneficiaries' quality of life is improving steadily.

As a result of considering these comprehensively, the impact of this project, "contribution to poverty reduction in the project areas" is deemed to be confirmed.

3.3.2 Other Impacts

(1) Impact on the natural environment

According to Indonesian domestic law[8], 19 of the subprojects were classified as Category A where the submission of an environmental impact assessment report was mandatory and 8 subprojects were classified as Category B. Since this project is a sector loan, it was expected that the Scope of Work for subprojects may be reviewed after project implementation and that the number of subprojects may change accordingly[9]. Therefore, it was agreed that construction would commence upon approval by JICA after the executing agency conducted environmental screening based on the "JBIC Environmental Guidelines for ODA Loans" (October, 1999).

At the time of the ex-post evaluation, the Evaluator attempted to verify if the process described above was completed. However, the project completion report did not contain any information on environmental appraisal, and it turned out that the executing agency was not aware of whether environmental impact assessments had been conducted, nor did they know the status of environmental monitoring, partly due to decentralization. Under these circumstances, it was not possible to verify whether environmental impact assessments were carried out or how things were monitored with the subprojects classified as A or B at appraisal. This is except for the seven subprojects where a site survey, survey and detailed analyses were conducted.

For the 7 subprojects where a site survey was conducted, environmental approvals and the monitoring status are indicated in Table 15. At the time of ex-post evaluation the sites are still monitored except for the Malaka and Sausu irrigation projects.

[8] The Decree of the State Minister of the Environment No.17/2001. This law was partially revised in 2006 (the Decree of the State Minister of the Environment No.11/2006).

[9] Nine out of 19 projects were divided into more than two projects after the project started.

Table 15: EIA and Monitoring at Subprojects Selected for Site Survey

Subproject	Environmental Category at Appraisal	Assessment Conducted	Time Approved	Notes: Monitoring Status
Malaka Weir Irrigation Project	A	Unknown	Before project implementation	Air pollution due to heavy machinery use and dust emission was confirmed in 2001- 2003. Need to confirm if inland fishing takes place in the reservoir. As of the time of ex-post evaluation, not monitored.
Ponre-Ponre Dam Irrigation Project	A	Environmental impact assessment (2001)	Before project implementation	Currently As of the time of ex-post evaluation, the Provincial DOWR conducts monitoring and reports to the MOPW.
Paguyaman Weir Irrigation Project	A	Environmental impact assessment	Before project implementation (2004)	Monitoring conducted by Provincial DOWR as of the time of ex-post evaluation. No major issues were confirmed.
Benua Aporo Weir Irrigation Project	A	Environmental impact assessment	Before project implementation	Monitoring conducted by Provincial DOWR as of the time of ex-post evaluation. No major issues were confirmed.
Sausu Weir Irrigation Project	A	Unknown	Unknown	As the Central Sulawesi Irrigation Project, classified as Category A at appraisal. Evaluated in detail after project commencement and divided into three subprojects including Sausu. Currently not monitored
Telaga Lebur Pond Irrigation Project	A	Environmental impact assessment (2006)	Before project implementation	As the West Nusa Tenggara Pond Improvement Project, classified as Category A at appraisal. Evaluated in detail after the project kicked off and divided into three subprojects including Telaga Lebur. Monitoring conducted by Provincial DOWR as of the time of ex-post evaluation. No major issues were confirmed.
Kempo Groundwater Irrigation Project	B	Environmental impact assessment	Before project implementation	As the West Nusa Tenggara Groundwater Irrigation Project, classified as Category B at appraisal. Evaluated in detail after the project kicked off and divided into three subprojects including Kempo. Monitoring conducted by Provincial DOWR as of the time of ex-post evaluation. No major issues were confirmed.

Source: Questionnaire survey results and JICA internal document

(2) Land acquisition and resettlement

At the time of project appraisal, a total of 683 ha land acquisition and resettlement of 33 households were anticipated at nine sites.

Table 16 summarizes the original plan and actuals for land acquisition and resettlement. There is little information regarding land acquisition and resettlement in the project completion report. The Evaluator attempted to obtain related information, but the executing agency was not aware of details of these matters partly due to government decentralization.

Table 16: Status of Land Acquisition and Relocation of Residents

	Plan		Actual	
	Subproject	Scale	Scale	Notes
Land Acquisition	Nangkara/Dompu Irrigation	26 ha	Unknown	-
	Sumbawa Dam Additional Works	30 ha	45.82 ha	Evaluated in detail after the project kicked off. Divided into two subprojects (Pelaparado Dam Irrigation and Batu Bulan Dam Irrigation). For the Batu Bulan Dam Irrigation Project, 28 ha of land was acquired for weir construction (March 2004), and 18.82 ha of land was acquired for updating a pipe line route (Nov 2003).
	Malaka Weir Irrigation	48 ha	0 ha	After consultation with residents land acquisition was canceled.
	Wae Dingin Irrigation	120 ha	0 ha	After consultation with residents land acquisition was canceled.
	Ponre-Ponre Dam Irrigation	304 ha	559 ha	Land for irrigation facilities: 136ha, Land for dam: 423ha
	Benua Aporo Weir Irrigation	87 ha	0 ha	Details unknown
	Sangkub Weir Irrigation	29 ha	Unknown	0ha for the right bank
	Paguyaman Weir Irrigation	22 ha	0 ha	The government completed land acquisition on the right bank 10 years prior to the project (1992). Details for other locations are unknown.
	Bella Kumpi Weir Irrigation	17 ha	Unknown	-
	Total	683 ha	-	-
Resettlement	Ponre-Ponre Dam Irrigation Project	33 households	33 households	All households received home renovations and purchased vehicles after relocation. No specific long term problems regarding compensation.

Source: Questionnaire survey results and JICA internal document

(3) Unintended positive/negative impact

None.

In summary, both qualitative and quantitate effects and the significance of the project irrigation facilities are high, and from the beneficiary survey, the project impact, “contribution to poverty reduction in the project areas”, is also apparent. On the other hand, some information regarding environmental impact and land acquisition was missing. In light of the above, it is determined that certain effects were confirmed in this project. Therefore the effectiveness and impact of the project are fair.

3.4 Efficiency (Rating: ②)

3.4.1 Project Output

(1) Irrigated area

The total irrigated area was 99,250 ha at the time of appraisal. The total coverage increased to 117,588 ha as of the time of the ex-post evaluation.

(2) Number of subprojects / contracts

At the time of project appraisal, 27 subprojects were planned, in order to construct and rehabilitate irrigation facilities in a vast area covering Bali province, West Nusa Tenggara province, East Nusa Tenggara province and five provinces on Sulawesi Island. At the time of the ex-post evaluation, it was confirmed that the number of subprojects had increased to 52. This is because some subprojects were further divided[10] as a result of more detailed design review conducted during the implementation period. Table 17 shows the subprojects planned and implemented in this project.

Table 17: Planned and Implemented Subprojects

Province	Plan		Actual		Number of contracts	
					LCB	ICB
Bali	1	Bali Weir Irrigation Improvement	1	Saba Basin Irrigation	1	0
			2	Unda Basin Irrigation	1	0
			3	Bilukpoh-Tukadaya Basin Irrigation	1	0
	2	Bali Groundwater Irrigation	4	Bali Groundwater Irrigation	1	0
West Nusa Tenggara	1	Nangkara/Dompu Irrigation	1	Nangkara Irrigation Right Bank	1	0
	2	West Nusa Tenggara Pond Improvement	2	Pompong Pond Irrigation	1	0
			3	Tibu Kuning Pond Irrigation	1	0
			4	Telaga Lebur Pond Irrigation	1	0
	3	Sumbawa Dam Additional Works	5	Pelaparado Dam Irrigation	3	0
			6	Batu Bulan Dam Irrigation	2	0
	4	West Nusa Tenggara Irrigation Improvement	7	Jurang Sate Irrigation Improvement	1	0
			8	Mamak-Kakiang Irrigation Improvement	1	0
			9	Sambella Groundwater Irrigation	1	0
			10	Santong Irrigation	1	0
	5	West Nusa Tenggara Groundwater Irrigation	11	Sambelia Groundwater Irrigation	1	0
			12	Kempo Groundwater Irrigation	1	0
			13	Sumbawa Groundwater Irrigation		

[10] One of the reasons why subprojects were divided into more segments was because the scope for each subproject at appraisal was based on a rough estimate and more accurate design requirements were clarified only after a detailed on-site survey and further design reviews, resulting in a more realistic project scope later. Additionally, some subprojects were rehabilitation works of existing Japanese ODA loan projects (such as rehabilitation of the Jeneberang River dam and its hydraulic drop in South Sulawesi province), and four subprojects were taken over from the Small Scale Irrigation Project (3).

Province	Plan		Actual		Number of contracts	
					LCB	ICB
East Nusa Tenggara	1	Malaka Weir Irrigation	1	Malaka Weir Irrigation	5	0
	2	Wae Dingin Weir Irrigation	2	Wae Dingin Weir Irrigation	1	0
	3	East Nusa Tenggara Irrigation & Pond Improvement	3	Kadumbul Weir Irrigation	1	0
			4	Bena Weir Irrigation	1	0
			5	Mautenda Irrigation Complex	1	0
			6	Danau Tua Pond Irrigation	1	0
			7	Haekrit Pond Irrigation	1	0
			8	Lokojange Pond Irrigation	1	0
	4	NTT Groundwater Irrigation	9	Ponu-Fatuoni Groundwater Irrigation	1	0
			10	Maumere Groundwater Irrigation	1	0
South Sulawesi	1	Ponre-Ponre Dam Irrigation	1	Ponre-Ponre Dam Irrigation	1	1
	2	Sadang Irrigation Improvement	2	Sadang Irrigation Improvement	1	0
	3	South Sulawesi Irrigation Improvement	3	Tabo-tabo Irrigation Improvement	1	0
			4	Kalamisu Irrigation Improvement	1	0
			5	Lamasi Kiri Irrigation	1	0
			6	Kanjiro Irrigation	1	0
			7	Rubber dam and Groundsill Rehabilitation [11]	1	0
	4	South Sulawesi Groundwater Irrigation	8	South Sulawesi Groundwater Irrigation	1	0
Southeast Sulawesi	1	Benua Aporo Weir Irrigation	1	Benua Aporo Weir Irrigation	2	0
	2	Southeast Sulawesi Irrigation Improvement	2	Kambara Irrigation	1	0
			3	Watotobi Irrigation	1	0
	3	Southeast Sulawesi Groundwater Irrigation	4	Konawe Selatan GW Irrigation	1	0
			5	Buton GW Irrigation	1	0
Central Sulawesi	1	Bela Kumpi Weir Irrigation	1	Bela Kumpi Weir Irrigation	1	0
	2	Central Sulawesi Irrigation Improvement	2	Sinorang Irrigation	1	0
			3	Karaopa Irrigation	1	0
			4	Sausu Weir Irrigation	2	0
	3	Central Sulawesi Groundwater Irrigation	5	Central Sulawesi Groundwater Irrigation	1	0
North Sulawesi	1	Sangkub Weir Irrigation	1	Sangkub Weir Irrigation	1	2
	2	North Sulawesi Irrigation Improvement	2	North Sulawesi Irrigation Improvement	1	0
	3	North Sulawesi Groundwater Irrigation	3	North Sulawesi Groundwater Irrigation	1	0
Gorontalo	1	Paguyaman Weir Irrigation	1	Paguyaman Weir Irrigation	1	3
	2	Gorontalo Irrigation Improvement	2	Gorontalo Irrigation Improvement Phase-1 (4 sites)	1	0
			3	Gorontalo Irrigation Improvement Phase-2 (2sites)	1	0
	3	Gorontalo Groundwater Irrigation	4	Gorontalo Groundwater Irrigation	1	0
Total	27		52		60	6

Source: Developed by the Evaluator based on related documents
Note: LCB: Local Competitive Bidding, ICB: International Competitive Bidding

[11] Government of Japan has extended its assistance to the rehabilitation of the Jeneberang River dam and its hydraulic drop by providing ODA loans to “Lower Jeneberang River Urgent Flood Control Project” (FY1984) (L/A amount: 5,381 million yen) and “Bili-Bili Irrigation Project” (FY1996) (L/A amount: 5,472 million yen).

At the time of appraisal, the number of contract packages was estimated at 28. With the increase in subprojects, the number of contracts had reached 66 at the time of ex-post evaluation[12].

(3) Consulting Services

At the time of appraisal, consulting services worth 26,636 man months were planned for (a) - (g) below:

(a) Project management
- Support at the central government level for the entire project
- Support at the local government level for the execution of each subproject

(b) Research for future irrigation development program formulation in Eastern Indonesia
- Survey, design, pre-qualification appraisal and bidding assistance, construction management for civil engineering work in each subproject

(c) Enhancement of WUA and skills development in Provincial / District DOWR
- Building structures for the formulation and enablement of WUA (collaboration with NGOs and local academic institutions)
- Providing guidance to WUA for operation and maintenance, and agricultural activities (facilitation through NGOs and local academic institutions)
- Skills development for provincial / district irrigation department staff for project implementation and operation and maintenance

(d) Dam irrigation project supervision

(e) Weir irrigation project supervision

(f) Irrigation rehabilitation project supervision

(g) Groundwater irrigation project supervision
- Quality management by each contractor related to civil engineering

During the project implementation period, the contract was updated with additional items listed below, and the actual for the total consulting service came in at 43,775 man months (increased by 17,139 man months). This increase was unavoidable given the increasing management works and additional services required due to the increase in subprojects and construction contract packages.

[12] Multiple contract packages were in place when a contract was divided into LCB and ICB and when construction took place in multiple locations. As a result, the number of construction contracts increased in proportion to the number of subprojects.

Table 18: Background of Provision of Additional Consulting Services

Additional Works	Background
Detailed design for the Kelara Karalloe Dam (South Sulawesi province)	Required in order to ensure the quality of technical service for increasing the project maturity.
Technical assistance for agriculture extension activities	Required in order to strengthen farmers' capability and enhance agriculture extension works through employment of community workers.
Support for scoping the subsequent project (Decentralized Irrigation System Improvement Project in Eastern Region of Indonesia (II))	Required for design review of subsequent project, pre-qualification and preparation of bidding document.
Increasing amount of project management work	Required to cope with the increase in the number of contract packages.

Source: JICA internal documents.

3.4.2 Project Input

3.4.2.1 Project Cost

The actual cost of the project was 29,549 million yen against the planned project cost of 31,806 million yen (92% of the plan). Despite the increase in the contract packages due to subproject segmentalization and significant additions to consulting services, the cost was lower than planned due to the high appreciation of the Japanese yen and depreciation of the Indonesian rupiah during the project implementation period.

Table 19: Plan and Actual of Project Cost

Unit: million yen

Budget Item	Plan						Actual					
	Foreign Currency		Local Currency		Total		Foreign Currency		Local Currency		Total	
	Total	Loan	Total	Loan	Total	Loan	Total	Loan	Total	Loan	Total	Loan
Construction	1,221	1,221	19,656	19,656	20,877	20,877	698	698	19,506	19,506	20,205	20,205
Equipment	0	0	260	260	260	260	0	0	0	0	0	0
C/S	1,220	1,220	3,618	3,618	4,838	4,838	1,649	1,649	3,687	3,687	5,336	5,336
Contingency	64	64	1,023	996	1,087	1,060	0	0	0	0	0	0
Land acquisition	0	0	540	0	540	0	0	0	435	0	435	0
Administration	0	0	1,541	0	1,541	0	0	0	1,340	0	1,340	0
Taxe and duties	0	0	2,663	0	2,663	0	0	0	2,233	0	2,233	0
Total	2,505	2,505	29,301	24,530	31,806	27,035	2,347	2,347	27,202	23,194	29,549	25,541

Source: Questionnaire survey response from executing agency
Note 1: Numbers are rounded to the millions, so there are some discrepancies between the total amount and the sum of items
Note 2: C/S: Consulting Services

3.4.2.2 Project Period

The planned project period was 63 months from October 2002 (L/A signed) to December 2007 (expected completion of consulting services contract). However, the actual project duration was 108 months from October 2002 to December 2011 (171% of the plan), exceeding the original plan significantly. The extension was unavoidable to achieve an appropriate project

outcome given the increase in the number of subprojects, construction contract packages and additional services.

The main reasons for the extended project period are as follows:

(a) Increased construction contracts

The number of contract packages was initially 28. In the end, the number of contracts for the completed subprojects was 66.

(b) Extended construction due to delays in construction contract lots

For the reason (a) above, it took longer than expected to complete signing of construction contracts. Because of this delay, consulting services were extended by approximately one year.

(c) Additional construction contracts

Certain components were added to Sausu Weir Irrigation Improvement (Central Sulawesi province), Sangkub Weir Irrigation (North Sulawesi province), and Paguyaman Weir Irrigation (Gorontalo province), which increased desk work. As such and accordingly, the consulting services period was extended by two years.

(d) Additional services

Following items were added to consulting services:

- Support for scoping the subsequent project (Decentralized Irrigation System Improvement Project in Eastern Region of Indonesia (II))

  A project formulation survey was conducted from September 2005 to June 2008 and reports were submitted from April to November 2007. Design review was conducted from July 2006 to August 2008. Combined with reviews on other services, this contributed to the extension of the project for the total of approximately one year.
- Increased works on project management

  With (a) to (c) of the above, the volume of management work increased. Combined with reviews on other services, this contributed to the extension of the project for the total of approximately three years.

3.4.3 Results of Internal Rate of Return (Reference only)

The Financial Internal Rate of Return (FIRR) at project appraisal was not calculated, and the Economic Internal Rate of Return (EIRR) of the project was 21.33%. Below is the rationale for the EIRR at the time of calculation:

Cost:	Cost required for construction and operation and maintenance of this project
Benefit:	Expansion of irrigated area, increase in unit yield, increased crop production volume through higher land usage rate
Project life:	Dam and pond irrigation: 50 years after project commencement Weir and groundwater irrigation: 25 years after project commencement
Period for effect realization:	Production of each product should increase 20% of the target annually and reach 100 % in the 5th year

In this ex-post evaluation, FIRR is not calculated as in the appraisal. Since this project has numerous subprojects, information gathering within the ex-post evaluation period is difficult. In addition, output content is very different from what was planned initially, therefore a comparison of before and after the project cannot be done appropriately. For these reasons, it is not possible to analyze EIRR in this ex-post evaluation.

To summarize, although the project cost was within the plan, the project period far exceeded the plan. Therefore, efficiency of this project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

Domestic law and government regulations enacted in 2004 and 2006 [13] define the operation and maintenance framework based on the difference of irrigation area. When the area becomes smaller-scale, subordinate organizations become responsible for the operation and maintenance of primary and secondary canals from the MOPW, provincial governments, to district governments. WUAs take the main roles in the operation and maintenance of tertiary canals no matter how big the irrigated area is (Table 20). The above government regulation stipulates an exception that "when a subordinate organization does not have financial / managing abilities, its supervising organization shall be accountable" to remain flexible in the development of implementation arrangements for operation and maintenance.

[13] The Water Resources Law No.7 of 2004 (UUSDA 7/2004), the Government Regulation No.20 of 2006 (PP 20/2006). No new regulations / revisions regarding water resource management have been made since 2006.

Table 20: Organizations Responsible Officially Mandated for Operation and Maintenance

Irrigation Schemes	Primary Canal		Secondary Canal		Tertiary Canal	
	Source	Agency Responsible	Source	Agency Responsible	Source	Agency Responsible
Over 3000 ha and overlaps multiple provinces	MOPW	DGWR, MOPW	MOPW	DGWR, MOPW	Determined by WUA	WUA
Over 1000 ha and less than 3000 ha; overlaps multiple districts	Provincial government	Provincial DOWR	Provincial government	Provincial DOWR	Determined by WUA	WUA
Less than 1000 ha	District government	District DOI	District government	District DOI	Determined by WUA	WUA

Source: The Water Resources Law No.7 of 2004 (UUSDA 7/2004), the Government Regulation No.20 of 2006 (PP 20/2006)

Table 21 shows which organization is responsible for operation and maintenance at different levels of canal facilities in the 7 subprojects selected for site survey (Malaka Weir Irrigation, Ponre-Ponre Dam Irrigation, Paguyaman Weir Irrigation, Sausu Weier Irrigation Improvement, Telaga Lebur Pond Irrigation, Kempo Groundwater Irrigation). With Malaka Weir Irrigation, Ponre-Ponre Dam Irrigation, Benua Aporo Weir Irrigation and Sausu Weir Irrigation Improvement subprojects, the operation and maintenance of tertiary canals was transferred to WUA and streamlined according to regulations. In these four projects, WUA formulation rates are various: 45%, 23%, 12% and100% respectively. In Ponre-Ponre, for instance, only 1,000 ha out of 4,337 ha is covered by WUA, and 80 volunteers per water gate are deployed to maintain the facilities. But they are not yet able to cover all of their tertiary canals. Except for the Sausu project where WUA formulation rate is 100%, local DOA is covering the shortage to assist WUA with tertiary canal maintenance.

The reason that local DOA are involved in tertiary canal management is that they are more needed at field level as they are closer, and mainly support WUA management and their activities on behalf of the MOA which is supposed to take responsibility in management of WUA as stipulated in the government regulation enacted in 2007[14].

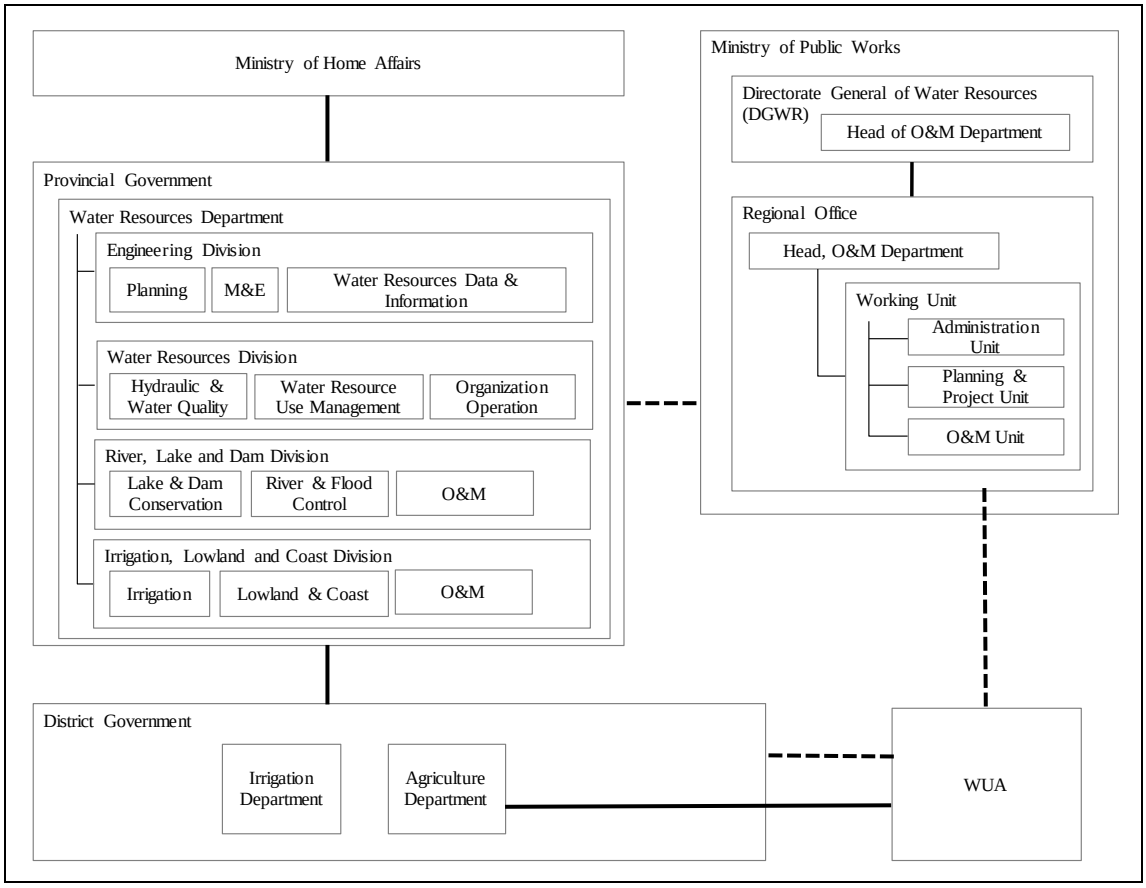
[14] The Government Regulation No.38 of 2007 (PP 38/2007)

Table 21: Organizations Responsible for Canal Facilities

Subproject	Irrigated area (ha)	Primary canals		Secondary canals		Tertiary canals		WUA Formulation Rate
		Source	Agency Responsible	Source	Agency Responsible	Source	Agency Responsible	
Malaka Weir Irrigation	5,716	N/A	Balai Office	N/A	Provincial DOWR	N/A	WUA and District DOA	45%
Ponre-Ponre Dam Irrigation	4,331	MOPW	Balai Office	Balai Office	Provincial DOWR	Local DOA	WUA (Supervised by local DOA)	23%
Paguyaman Weir Irrigation	5,774	N/A	Balai Office and WUA	N/A	Balai Office and WUA	N/A	Balai Office and WUA (Supervised by local government when needed)	40%
Benua Aporo Weir Irrigation	3,010	MOPW	Balai Office	MOPW	Provincial DOWR	Local DOA	WUA (Supervised by local DOA)	12%
Sausu Weir Irrigation	5,146	MOPW	Balai Office	Provincial Government	Provincial DOWR and WUA	WUA	WUA	100%
Telaga Lebur Pond Irrigation	102	MOPW	Balai Office	MOPW	Balai Office	MOPW	Farmers' Association and District DOA	0%
Kempo Groundwater Irrigation	102	N/A	Farmers' Association	N/A	Farmers' Association	N/A	Farmers' Association (Technical support by local government when needed)	0%

Source: Questionnaire survey results from executing agency

In Paguyaman, next, while the Balai Office and WUA are jointly responsible for canals from primary to tertiary, the WUA formulation rate remains at 40%. In order to cover the shortage, a structure has been built in which facility operation and maintenance is conducted with the coordination, collaboration and cooperation with the Provincial DOWR and District DOA on the ground. Figure 1 shows the cooperative structure among related organizations for operation and maintenance.



Source: Developed by the Evaluator based on the survey responses from the executing agency.
Note 1: It depends on each province and district how local government is involved in the management of the irrigation systems. This figure shows the institutional arrangements of Gorontalo Province for the management of the irrigation system of Paguyaman as one example.
Note 2: I The solid lines in the figure show the direct relations for jurisdiction and the chain of command in-between. The dashed lines show indirect and relevant conditions among organizations. For instance, WUA are under the jurisdiction of the MOA, and the solid line between the District DOA and WUA shows the leading role of DOA vis-à-vis WUA in Paguyaman on behalf of MOA. On the other hand, the dashed line between WUA and the MOPW shows indirect relations.

Figure 1: Organizational Structure for O&M at Paguyaman Weir Irrigation Project

Comments from a beneficiary who is engaged in the operation and maintenance of the Paguyaman facilities are quoted in the sidebar below.

Note: Gate operator (left) and interviewee, sluice operator (right)

Photo 3: Operation at Paguyaman Irrigation Facilities

Note: Photo taken in April, 2014

Photo 4: Dam at Paguyaman Irrigation Facilities

From a beneficiary interview: Farmer A, sluice operator (42 years old)

I am a WUA member, and chair the WUA Union comprised of several WUAs. I am in charge of sluice control when there is a flood at the Paguyaman irrigation facilities. I monitor the amount of weir water during the rainy season at rainy times of the day to see if a flood happens. When the water volume is high, I work with my friend who is in charge of the gate operation to open the weir gate.

Before we had these facilities, we relied on rain to grow rice, but now we can crop rice twice a year. I have 3 ha of farmland, and I can get 2,500 rupiah from 1 kilogram of rice. Combined with my wages as the sluice controller, my income has improved reasonably compared to the time we didn't have the facilities.

It's been only 3 years since we formed our WUA, so as an organization we need to learn more, but we are cooperating to protect the facilities. When it rains heavily at night, I come to help, and other residents who have heard the rain also gather to help. The residents, including myself, are all from the area, so we have known each other for a long time, and we trust each other.

(Interviewed on 28 April, 2014)

For Telaga Lebur Pond Irrigation and Kempo Groundwater Irrigation projects where the WUA formulation rate remains 0%, the Balai Office monitors the primary and secondary canals in Telaga Lebur, and Farmers' Associations[15] maintain the tertiary canals on behalf of WUAs. In Kempo, Farmers' Associations are particularly active and they take on all the maintenance from primary to tertiary.

As seen above, a legal system for irrigation facility management has been developed, and the jurisdiction and division of roles are being clarified. Based on this framework, related organizations are cooperating as required. Even with the subprojects where WUA formulation rates are low, strong field-level operation structures are present, as seen in the case where the local DOA and Balai Office cover the management of tertiary canals for WUA. Therefore there are few problems in the institutional aspect.

[15] Farmers' Associations are under supervision of the MOA as WUAs are.

3.5.2 Technical Aspects of Operation and Maintenance

(1) Technical skills required the operation and maintenance of canals

Regarding the current technical skills of operation and management of primary to tertiary canals under the structure seen above, the Evaluator conducted on-site hearings and interviewed staff from related organizations in the site survey to find the following:

(a) Malaka Weir Irrigation Project

Some voluntary efforts are made to respond to technical challenges. For example, agricultural water management technical staff are invited from the District DOA to solve technical issues. However, the water management skills of WUA staff, who are in charge of the management of tertiary canals, are not sufficient.

(b) Ponre-Ponre Dam Irrigation Project

WUA water management staff are lacking in both quality and quantity. Learning opportunities and directions from local DOA are desired.

(c) Paguyaman Weir Irrigation Project

Since the human resources of WUA are limited, retired technical staff are coaching board members of WUA with regard to water management and cultivation methodologies. Among the seven sites surveyed, only Paguyaman had such an effective use of retired engineers.

(d) Benua Aporo Weir Irrigation Project

A WUA is responsible for the operation and maintenance of tertiary canals supervised by local DOA. It was pointed out that the water management skills and technical knowledge are lacking on the part of the WUA, but that the supervising local DOA is not offering learning opportunities.

(e) Sausu Weir Irrigation Project

No information was available regarding skills for operation and maintenance as a result of the survey.

(f) Telaga Lebur Pond Irrigation Project

The central government conducts operation monitoring. A Farmers' Association is involved actively and manages the tertiary canals. Despite the availability of skills development training, the water management skills of technical staff are still not sufficient.

(g) Kempo groundwater Irrigation Project

A Farmers' Association is actively involved and canals are well maintained. Information on the technical level of the Farmers' Association was not available, but the local government is providing support and directions for the operation and maintenance of tertiary canals as required based on their water management expertise.

(2) Inspections and repair works of irrigation facilities

Table 22 shows the jurisdiction of responsibilities and the frequency of each inspection and repair works at each subproject irrigation facility. At each project, regular and periodic inspections and large-scale repair works are mainly in the hands of either Balai Office or local DOWR.

In many of the sites, sediments and mud get stuck and trash, sand and mud in irrigation canals at lower streams are more than the designed amount (See 3.5.4 Current Status of Operation and Maintenance). The present regular checkups and repairs are not technically sufficient or as frequent as required, which has hindered the proper operation of the site facility. Urgent improvement is desired, but detailed information on countermeasures for such an improvement was not obtained as a result of the site survey.

Table 22: Agencies Responsible for Maintenance Works, Frequency and Contents

Subproject	Item	Daily Inspection	Periodic Inspection	Large-scale Works
Malaka Weir Irrigation Project	Responsible organization	District DOWR	Provincial DOWR	Balai Office
	Frequency	Every two months	Once a year	As required
	Tasks	Weeding, sediment removal from primary canals	Sediment removal from secondary canals	Garbage and sediment removal, water gate maintenance, facilities rehabilitation
Ponre-Ponre Dam Irrigation	Responsible organization	Balai Office	Balai Office	Balai Office
	Frequency	Weekly	Monthly	As required
	Tasks	Weeding, lubricating water gates	Garbage removal from water intake gate Lubrication on water intake gate	-
Paguyaman Weir Irrigation	Responsible organization	Balai Office	Balai Office	Balai Office
	Frequency	Four times a year	Once a year	Once a year
	Tasks	Weeding	Sand/mud removal	Painting buildings, road maintenance, sediment dredging in upper stream areas
Benua Aporo Weir Irrigation	Responsible organization	Balai Office	Balai Office	Balai Office
	Frequency	Every three months	Every Year	As required
	Tasks	Weeding (once a month), garbage removal (once in three months)	Lubricating water intake gate	Office facilities maintenance

Subproject	Item	Daily Inspection	Periodic Inspection	Large-scale Works
Sausu Weir Irrigation	Responsible organization	Balai Office	Balai Office	Balai Office
	Frequency	-	-	-
	Tasks	-	-	-
Telaga Lebur Pond Irrigation	Responsible organization	Balai Office	Balai Office	Balai Office
	Frequency	Three times a year	Once a year	As required
	Tasks	Payroll Dam cleaning Lubricating water gates	Lubricating water gates, painting facilities, sediment removal	Rehabilitation
Kempo Groundwater Irrigation	Responsible organization	Farmers' Association	Farmers' Association	Balai Office
	Frequency	Once in 3-4 months	Once a year	As required
	Tasks	Engine oil change	Water distribution management to canals using water pumps, maintenance and spare parts replacement of water pumps	Engine repairs etc

Source: Questionnaire survey results from executing agency

(3) Status of human resources development

Table 23 shows the status of human resource development at the seven subprojects where site surveys were conducted. The technical skills of current staff are not sufficient and it is desired that they are further developed.

Table 23: Training Opportunities for O&M Staff

Subproject	Program	Target	Frequency
Malaka Weir Irrigation Project	Technical skill development for maintenance and management WUA enablement	Maintenance management staff (30 staff)	Once a year
Ponre-Ponre Dam Irrigation Project	Technical skill development for maintenance and management	Maintenance management staff	Once a year
Paguyaman Weir Irrigation Project	Knowledge enhancement	Maintenance management staff (30 staff)	Once a year
Benua Aporo Weir Irrigation Project	Technical skill development for maintenance and management	Maintenance management staff	Once a year
Sausu Weir Irrigation Project	N/A	N/A	N/A
Telaga Lebur Pond Irrigation Project	Dam operation and management	1-2 staff	10 times a year
	River bank management	1-2 staff	
	Natural disaster management	1-2 staff	
	Irrigated low ground management	1-2 staff	
Kempo Groundwater Irrigation Project	Dam operation and management	1-2 staff	10 times a year
	River bank management	1-2 staff	
	Natural disaster management	1-2 staff	
	Irrigated low land management	1-2 staff	

Source: Survey results from executing agency

According to the government regulation (Government Regulation No.38: Enacted in 2007), the MOA is responsible for the skills development of WUA, and a framework has been established where WUA formulation and skill development are assisted through NGOs, and where WUA are provided with agricultural advisories and training for water management and the operation maintenance of competed irrigation systems. However, the supervisory activities of the Ministry and local governments are not sufficient.

To summarize, as outpost agencies of the MOPW, the roles assumed by Balai Offices in the field, such as the sharing of technical skills, are quite significant, and there are high expectations from related parties making skills improvement for Balai staff an urgent issue. Educating WUA for better maintenance skills and technical abilities is also important, but there isn't sufficient advisory for WUA by the MOA and local DOA. Under these circumstances, the quality of regular and periodic maintenance works and major repairs is not high. Nor is it high in quantity. Information on detailed measures for improvement was not obtained as the result of the survey.

Therefore, it can be said that there are problems with the technical aspect of operation and maintenance to some extent.

3.5.3 Financial Aspects of Operation and Maintenance

At the seven subprojects where site survey was conducted, MOPW and its outpost, Balai Office, local government (DOWR and DOA) and WUA bear the budget to ensure the operation and maintenance arrangements at each canal. Balai Office and local government are supposed to allocate the budget for regular and periodic checkups and repairs.

Table 24 shows the transition of budget allocation by the MOPW on the operation and maintenance of each facility. The Department of Operation and Maintenance of the Ministry is a new department created recently, and cases have been confirmed where Balai Office was not able to secure the sufficient maintenance budget that they requested in a timely manner.

Table 24: O&M Cost for Each Subproject allocated by the MOPW

Unit: 1000 rupiah

Subproject	2009	2010	2011	2012	2013
Malaka Weir Irrigation Project	1,005,000,000	1,072,000,000	1,072,000,000	1,206,000,000	1,340,000,000
Ponre-Ponre Dam Irrigation Project	-	-	692,960,000	779,880,000	886,200,000
Paguyaman Weir Irrigation Project	565,675	600,000	1,350,800	477,230	750,003
Benua Aporo Weir Irrigation Project	-	710,000,000	570,000,000	263,200,000	280,000,000
Sausu Weir Irrigation Project	921,900	983,360	1,311,360	1,475,280	1,639,200
Telaga Lebur Pond Irrigation Project	-	-	93,447,144	30,744,491	40,334,434
Kempo Groundwater Irrigation Project	26,300,000	33,538,000	46,500,000	59,341,700	102,829,000

Source: Survey responses from executing agency

No information on budget and expenditure by the local government was available at the end of the survey. As admitted in Sausu, WUAs find funds for operation and maintenance voluntarily. However, information on the amount they actually pay was not obtained as their answers remained as “such financial contribution is insufficient”. In Ponre-Ponre and Paguyaman, it is also thought that WUA members make voluntary contributions. However money is collected only from some of the members and the amount is not sufficient. Actual figures of their financial contribution were not obtained.

From the observations above, it can be seen that the financial sustainability for operation and maintenance has some problems. Empowerment of the Department of Operation and Maintenance of MOPW and its ability to deploy budget in order to improve finances for operation and maintenance is urgently needed. The budget and expenditure by the local government remains unknown, but theirs is an important role on the ground level for immediate response. Sufficient allocation of their budget is desired. Securing the financial contribution from WUA members is also an urgent issue to be tackled.

3.5.4 Current Status of Operation and Maintenance

At the seven facilities where site surveys were conducted at the time of the ex-post evaluation (2014), occasional problems were seen with water distribution, but the situation did not mean stopping the irrigation service itself. As shown in the site survey results summarized in Table 25, many sites have experienced unexpected situations such as landslides caused by logging in upper stream areas and unexpected large-scale floods, which produce large amounts of sediment and litter clogging the irrigation canals beyond the technical abilities and management capacity of the current operation and maintenance teams. Repairs and regular maintenance work are not sufficient in quality or quantity for coping with such events, and some facilities incurred damages after project completion requiring major repairs, as seen in the case of the Benua Aporo project, where a large-scale flood damaged the facilities.

Under these circumstances, it is imperative that the water management skills and the quality and quantity of regular maintenance and repair works by staff are enhanced and improved in order to better manage the facilities.

Table 25: Physical Conditions of Project Facilities at the Time of Site Survey

Subproject	Physical Conditions of Project Facilities
Malaka Weir Irrigation Project	Poor drainage and frequent floods partly due to landslides from the hills. Water diversion gates were damaged at multiple locations, but sluice gates were operating well despite the partial damages. According to the Balai Office, there isn't enough staff for operation monitoring, and they are not able to contain the stealing of water by local farmers. In some cases, holes are punctured through the canal and not enough water is distributed to lower stream areas. As a result some farmers are feeling that the water is not distributed fairly. (Photo 6)
Ponre-Ponre Dam Irrigation project	Landslides, sand sediment from water leakage and mud clogging caused multiple damages in canals. Lower streams are completely dry in both the dry and rainy seasons. Water reservoirs are also used for the local residents' recreation.
Paguyaman Weir Irrigation Project	A large amount of dirt and waste was pushed into the water due to illegal logging and gold mining in the upper stream area. Landslides and leakage damaged secondary canals, and sand / mud sediment piled up in the lower stream causing frequent floods in the rainy season (Photo 7). Other facilities were operating well.
Benua Aporo Weir Irrigation Project	A flood in July 2013 damaged the embankment and destroyed some facilities. Reconstruction work was underway in 2014 using budget from the Indonesian Government (Photo 8). Secondary canals on the right bank of the dam were not functioning due to the repair work. The water gate of the dam collected garbage, bamboo and wood pieces making the water stagnant. Further repair work on the tertiary canals are needed.
Sausu Weir Irrigation Project	Logging in the upper stream area caused wood pieces flowing into the water causing occasional clogging of the sluice. Sludge caused by floods made the water very cloudy. There are frequent water shortages in the lower stream area. There is a large amount of sand sediment, and quite a bit of damage to the facilities was seen (Photo 9).
Telaga Lebur Pond Irrigation Project	Water supply to residences was functioning well, but some of the main gates were damaged. As many as 4 valves that take the water from the dam to primary canals were damaged, so some farmers were relying on rain water.
Kempo Groundwater Irrigation Project	Some of the electric pumps for taking surface water were not used as farmers were reluctant to bear the expense. As a result, often they rely on rain water resulting in unstable cropping. Farmers are working together to repair usable pumps. 3 were working well, 2 were OK and one was out of order.

Source: Site survey (Completed in May - June 2014)

Note: Canal is clogged and water is not flowing. Photo taken in May 2014

Photo 5: Tertiary Canal in Malaka

Note: Canal is clogged with mud and wood pieces from heavy rainfall. Photo taken in May 2014

Photo 6: Canal in Paguyaman

Note: Damaged by Flood. Photo taken in May 2014

Photo 7: Benua Aporo Irrigation Facilities

Note: Mud pile is hindering water distribution. Photo taken in May 2014

Photo 8: Tertiary Canal in Sausu

To summarize, in terms of maintenance and management of the project, there are minor problems in the technical and financial aspects and physical conditions of the facilities although there is no major issue with the institutional aspect. Unless these problems are addressed comprehensively, it is likely that the current conditions of the facilities will worsen further. Therefore, sustainability of the project is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project intended to increase food production, mainly the rice crop, thereby to contribute to poverty reduction in Eastern Indonesia through the new construction and rehabilitation of irrigation facilities and assistance for the institutional reinforcement of irrigation water management systems in the region.

This project was well in line with Japan's ODA policy as well as with Indonesian development policy and the country's development needs such as correcting regional disparities, increasing food production and securing water resources. Therefore the project relevance is high. Effectiveness of this project is considered high, as there are tangible effects and the importance of irrigation facilities improved under the project is clear. Dual rice cropping during rainy seasons and planting in dry seasons were made possible in the Eastern region where water resources were scarce and development projects are further needed. While a positive impact of the project, "contribution to poverty reduction in the project area", was confirmed and high effectiveness of the project was apparent from the beneficiary survey, the effectiveness / impact of the project is deemed fair, as some information regarding environmental impacts and land acquisition was not available.

Efficiency of the project is fair as the project cost did not exceed the planned budget, but the project period was significantly longer than planned. In terms of maintenance and management of the project, there are minor problems in the technical and financial aspects and

physical conditions of the facilities although there is no major issue with the institutional aspect. Unless these problems are addressed comprehensively, it is likely that the current condition of the facilities will worsen further. Therefore, sustainability of the project is fair.

In light of the above, the project is evaluated as partly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

In this project, daily field activities through resident organizations (WUAs and Farmers' Associations), such as canal cleaning and appropriate water gate operations, are essential to ensure optimal water volume throughout the irrigation systems and sufficient water distribution down to marginal areas. Also, it is very important that sufficient budget is allocated to each facility and that regular inspections and large and small-scale repair works are performed in a timely fashion.

Therefore, it is recommended that the executing agency and Balai Offices work closely with local DOA to provide long-term and continuous technical support to residents and their organizations to improve their technical skills levels required for daily maintenance checkups, to organize well-defined roles for related organizations and to promote sufficient budget allocation.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

4.3.1 Thorough Project Monitoring and Plan Reviews

Prior to the mid-term review of this project conducted in 2007, the project plan was revised significantly based on the implementation status at the time and in the circumstances after commencement of the project. In the mid-term review, the circumstances were clarified by a third party (evaluator), and information regarding the revision proposal for the Operation and Effect indicators was made public.

However, these Operation and Effect indicators were not defined outside of the pilot subprojects, and there was no confirmation of any official documents about the agreement on indicator revisions proposed in the mid-term review. As a result, the evaluator was forced to spend a significant amount of time investigating how the project scope was changed and which Operation and Effect indicator figures should be considered as the base and target figures. As a result, they were quoted as reference figures only.

In general, a sector loan such as this project does not necessarily finalize a detailed project scope during the period from project processing to appraisal. Often, a more accurate project scope is established when the design details are discussed after the project kicks off. Therefore,

it is possible that the project scope (number of subprojects and irrigation scale), Operation and Effect indicators and project period planned at the time of appraisal change significantly during the project period.

Going forward, it is strongly advised that for irrigation projects implemented under similar conditions, JICA and the executing agency review project scope, Operation and Effect indicators and project period as required, and that they create a written agreement on revisions in a timely fashion and perform monitoring and data collection based on these revisions. This would not only enhance JICA's monitoring capacities but also simplify the tasks for ex-post evaluations.

4.3.2 Feedback to Similar Projects

This project is in the fourth phase of the irrigation projects that have been implemented in a long-term and sustained manner in the eastern region of Indonesia since a Japanese ODA loan project was approved in 1989 (the Small Scale Irrigation Management Project (1)), and a subsequent project is also being presently implemented. Particularly in Nusa Tenggara province, which is plagued by little annual rainfall, the impact of this project on improving the diet of the beneficiary and on household income is remarkable. Securing water resources in the future is also important.

If JICA conducts an inter-schematic evaluation focusing on achievements in the series of projects implemented in the eastern region of Indonesia, verification of lessons learned from the general and long term perspectives could be used for inclusive poverty reduction of the farmers in the said region (which may not be limited to cooperation in the irrigation sector) as well as for capacity building for project management on the part of Indonesian Government officials,

Thus, it is desirable to refer to the verification results and lessons learned derived from the above inter-schematic evaluation when formulating a long term and extensive irrigation project as well as when considering its direction.

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Output (1) Subproject	27 in 8 provinces	52 in 8 provinces
(2) Contract package	28	66
(3) Irrigated area	Total 99,250 ha (New construction/expansion) a) Dam/Pond Irrigation: 5,768 ha b) Weir irrigation: 20,442 ha c) Groundwater irrigation: 2,723 ha (Rehabilitation) a) Pond irrigation: 5,845 ha b) Weir irrigation: 64,477 ha	Total 117,588 ha (New construction/expansion) a) Dam/ Pond Irrigation: 5,768 ha b) Weir Irrigation: 27,538 ha c) Groundwater Irrigation: 3,020 ha (Rehabilitation) a) Pond irrigation: 533 ha b) Weir Irrigation: 77,629 ha
(4) Consulting Services	Total 26,636 M/M	Total 43,775 M/M
2. Project Period	October 2002 - December 2007 (63 months)	October 2002 - December 2011 (108 months)
3. Project Cost		
Amount paid in Foreign currency	2,505 million yen	2,349 million yen
Amount paid in Local currency	29,301million yen (2,092,928million rupiah)	27,202 million yen (2,466,760 million rupiah)
Total	31,806 million yen	29,549 million yen
Japanese ODA loan portion	27,035 million yen	25,541 million yen
Exchange rate	1Rupiah = 0.014 yen (As of October, 2001)	1Rupiah = 0.011yen (Average between 2002 -2011)