Republic of Malawi

Ex-post Evaluation on Japanese Grant Aid Project

The Project for the Rehabilitation of the Bwanje Valley Irrigation System /

The Project for the Rehabilitation of the Bwanje Valley Irrigation System (Phase 2)

External Evaluator: Yuko Sugiyama, Octavia Japan Co., Ltd

0. Summary

In the Bwanje Valley Irrigation area, the target area of this project (the target area), headworks, irrigation and drainage canals, inspection roads and water supply boreholes were constructed from 1997 to 1999 under Grant Aid from the Government of Japan (GOJ). This grant aid project "Bwanje Valley Irrigation Development Project (the former project)" aimed at the development of irrigation of an area of 800 ha. However, the project's purpose as envisaged was not achieved since the irrigation facilities were damaged due to frequent floods. As a result, this project was implemented with the overall goal of increasing agricultural productivity in the target area. Under this project, rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management were conducted. The objectives of this project were to mitigate the risks against future floods of the irrigation facilities which had been damaged by previous floods, to restore the function of the facilities and to create a stable irrigation water supply to the irrigation area. Both at the time of project appraisal and ex-post evaluation, the project was consistent with the agricultural sector development policies and the needs of the irrigation development of the Republic of Malawi (Malawi). Thus, the relevance of this project was high. As a result of the rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management, the irrigated area reached the target level of 800ha. In addition, compared with the time of project appraisal, rice production increased 3.5 times after project completion. This suggests that the project has contributed to increasing the agricultural productivity in the target area. Furthermore, it is confirmed that farmers in the target area are highly satisfied with the project, according to the beneficiary survey. Therefore, effectiveness and impacts of the project is high. On the other hand, the efficiency of the project is fair, because project period was longer than planned, while the project cost was within the plan. Although no major problems were observed in the institutional aspect of Operation and Maintenance (O&M) carried out by the implementing agency, there were some concerns about the technical aspects of water management and the financial aspects of farmers' cooperative. Thus, the sustainability of this project is fair.

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

1. Project Description



Project Location



Rehabilitated Headworks

1.1 Background

In Malawi, agricultural production was low due to droughts and floods and also food shortages were serious caused by decreases in food reserves of the country. As a result, the Government of Malawi (GOM) has often requested emergency food aid from FAO and other donors. In order to cope with such food shortages and to achieve sustainable food productivity through irrigation development, the Ministry of Agriculture and Food Security (MOAFS) of Malawi has prioritized policies such as 'improvement of agricultural productivity through irrigation', 'strengthening of irrigation development programs' and 'rehabilitation and construction of irrigation schemes'.

In the Bwanje Valley Irrigation area, which is the target area of this project, irrigation and drainage canals, inspection roads and water supply boreholes were constructed by the former project. Irrigation services commenced in 2000. However, scouring and erosion of the flood protection dike occurred due to unprecedented floods in January 2002. In addition, the main canal and its operation road were seriously damaged. As part of a follow-up cooperation, GOJ assisted GOM in repairing the damaged dike and the main canal. However, the dike was again damaged by a flood in February 2003, resulting in the purpose of the former project not being achieved. Therefore, it was required to strengthen the irrigation facilities from the view point of disaster protection and to increase the function of the facilities.

1.2 Project Outline

This project was implemented at the Bwanje Irrigation Area, located near Mtakataka Trading Centre, in Dedza District, which is around 80 km east of the capital city Lilongwe. The objective of this project is to mitigate the risks against future floods and to create a stable irrigation water supply by rehabilitating headworks and settling basin, relocating the main canal and levelling the land, thereby contributing to improving agricultural productivity and farmers' incomes, as well as alleviating poverty in the target area.

Grant Limit/Actual Grant Amount	1,033 million yen / 1,031 million yen
Exchange of Notes Date	November 2005 (Detailed Design) / June 2006 (1 st phase) /
(Grant Agreement Date)	June 2008 (2 nd phase)
Implementing Agency	Ministry of Agriculture and Food Security (MOAFS)
	Lilongwe Agricultural Development Division (ADD)
Project Completion Date	September 2008 (Phase 1 and Phase 2)
Main Contractor	Konoike Construction Co., Ltd.
Main Consultant	Nippon Koei Co., Ltd.
Basic Design	"Basic design study on the Project for Rehabilitation of the
	Bwanje Valley Irrigation System in the Republic of Malawi"
	Japan International Cooperation Agency (JICA),
	February 2003 – November 2005
Detailed Design	January 2006 – June2006
Related Projects	[Technical Cooperation Projects]
	■"Development of Smallholder Irrigation Schemes
	Technical Cooperation Project" (2006-2009)
	[Grant Aid]
	■"Bwanje Valley Irrigation Development Project"(1996-
	1999)
	■"Follow-up Cooperation for the Bwanje Valley Irrigation
	Development Project" (2002-2003)"
	[Other international donors]
	■"Smallholder Flood Plains Development Programme
	IFAD ¹ " (1998–2006)

¹ International Fund for Agricultural Development

2. Outline of the Evaluation Study

2.1 External Evaluator

Yuko Sugiyama, Octavia Japan Co., Ltd.

2.2 Duration of Evaluation Study

Duration of the Study: January – November 2013

Duration of the Field Study: May 19 – June 3 and August 17 – 24, 2013

3. Results of the Evaluation (Overall Rating: B²)

3.1 Relevance (Rating: ③³)

3.1.1 Relevance with the Development Plan

At the time of the project appraisal, agriculture was the main economic sector in Malawi, contributing 40% of GDP (2003), employing 79% of the labour force (2002) and accounting for 83% of total exports (2003). In the national plans, such as "Vision 2020 (1997)", "Malawi Poverty Reduction Paper (2002)" and "Malawi Economic Growth Strategy (2004)", poverty reduction, food security, sustainable economic growth and development were identified as major goals. In these plans, the importance of agriculture and irrigation development was identified.

At the time of ex-post evaluation, GOM recognized irrigation development as one of the key strategies for economic growth, as addressed in "Malawi Growth Development Strategy II (2011-2016)", "Malawi Economic Recovery Plan (2012)" and "The Agriculture Sector Wide Approach (2010)". In the "Strategic Plan for Green Belt Initiative" developed in 2011, a target is to increase the country's irrigated area from 90,000ha to 200,000ha in order to improve agricultural productivity and to increase agricultural income by strengthening the sales of agricultural products.

As described above, the need for irrigation development continues to be an important issue for Malawi both at the time of project appraisal and ex-post evaluation. As such, it is confirmed that this project remains consistent with the development policy of Malawi.

3.1.2 Relevance with the Development Needs

With an aim of improving the quality of living of the poor through the development of irrigation, which is the prioritized area, the irrigation facilities were constructed under Grant Aid from GOJ from 1997 to 1999 in the Bwanje Valley Irrigation Area. However, the project effects

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

³ ③: High, ② Fair, ① Low

as envisaged were not achieved, since the irrigation facilities were damaged due to frequent floods after 2001. Under these circumstances, rehabilitation of the irrigation facilities was required urgently in order to strengthen the facilities fundamentally from the viewpoint of disaster protection and to increase the function of the facilities for attaining the project effects as envisaged.

At the time of ex-post evaluation, as agriculture still depends on rainfall in most of the rural part in Malawi, thereby causing unstable agricultural productivity in Malawi, there is still a high need for development of the country's irrigation facilities. Therefore, GOM has been strongly promoting irrigation development by establishing the "Irrigation Act" in 2001 and instituting the process of establishing the National Irrigation Board for sustainable irrigation development. Moreover, GOM plans to construct a dam at the Bwanje Valley Irrigation area to increase the irrigated area from its current 800ha to 2,100ha.

As described above, there continues to be a demand for developing irrigation facilities in Malawi. Therefore, the project is judged consistent with the development needs of Malawi at the time of ex-post evaluation.

3.1.3 Relevance with Japan's ODA Policy

GNI per capita in Malawi has been low (US\$160 in 2005) and the country has frequently been hit by natural disasters such as droughts. Therefore, providing assistance through ODA was significant from the perspective of poverty reduction, which was considered a priority issue in the general framework of ODA (2003). Because GOJ highly evaluated Malawi's work on economic reform, which prioritized the democratization and poverty reduction, GOJ strongly demonstrated the policy for assisting the country in the area of food aid and poverty reduction of poor farmers mainly by the schemes of grant aid and technical cooperation.

According to the Japanese Country Assistance Policy for Malawi in 2005, GOJ had prioritized 'food security' assistance to Malawi. This project is a rehabilitation project with the aim of achieving the effects as envisaged in the former project, which intends to contribute to food security in Malawi. Thus, the consistency with the Japanese assistance policy of this project is considered to be high.

In light of the above, the project has been highly relevant to the country's development plans and development needs, as well as Japan's ODA policy; therefore, its relevance is high.

3.2 Effectiveness⁴ (Rating:③)

- 3.2.1 Quantitative Effects (Operation and Effect Indicators)
- 1) Direct Effect of the Project (Irrigated area)

In order to mitigate flood risks to the main canal, it was relocated. Accordingly, the area irrigated by the new shifted main canal was changed from 800ha to 590ha. As a result, the target area of this project was considered to be 590ha irrigated by the new main canal. For the remaining 210ha, located between the existing main canal and the new main canal, responsibility of the project execution fell to GOM. However, the purpose of this project was to achieve the expected effects of the former project. In addition, rehabilitation of the headworks and construction of new settling basin were implemented through this project. In view of this, a 210ha area irrigated through the existing main canal was also considered to benefit from this project. Therefore, it should be appropriate to view the entire 800ha as having benefitted from this project⁵. On the other hand, it was estimated that irrigated area in the dry season would be approximately 145ha, as the water volume of the Namikokwe River decreases in the dry season⁶. Table 1 illustrates the irrigated area that was set as an effect indicator of this project.

Table 1: Data on Irrigated Area.⁷

								· · · ·
Indicator			Before Project Implementation (2004)	Target after Project Completion (2009)	(At Ex- 2009	Actual Project Co Post Eval 2010	after mpletion uation in 2011	n 2013) 2012
-	Marri	D		(2007)	2009	2010	2011	2012
	New Rainy		250	590	590	590	590	590
	canal	Season						
Irrigated	area	Dry	N/A	NI/A	202	250	00	00
	(590 ha)	Season		IN/A	292	230	90	90
area	Existing	Rainy			210	210	210	210
	canal	Season	N/A	N/A	210	210	210	210
	area	Drv	37/4		1.50	1.60	6.0	
	(210ha)	Season	N/A	N/A	160	168	60	15

(Before Project Implementation, Target and Actual after Project Completion)

(Unit · ha)

Source: JICA document and answer on questionnaire.

As can be seen from Table 1, irrigated area during the rainy season achieved 800ha every year

⁷ According to the implementing agencies, "irrigated area" refers to an area where water is distributed from the System served by the Namikokwe River. Rainy season : November—April, Dry season : May—October

⁴ Sub-rating for effectiveness is to be put with consideration of Impact.

⁵ At the time of project appraisal, the target level of the irrigated area was set as 590ha which would be irrigated though the new main canal.

⁶ In both of the former project and this project, irrigated area in the dry season was estimated 145 ha.

⁸ New canal area refers to the area irrigated by the new main canal. Existing canal area refers to the area irrigated by the existing main canal. Irrigated area in 2004 (250ha) was the irrigated area within the new canal area 590 ha.

following project completion (new canal area: 590ha, existing canal area: 210ha). Meanwhile, during the dry season in 2009 and 2010, as the quantity of rainfall was more than usual, the irrigated area exceeded 400ha. However, in the dry season in 2011 and 2012, the irrigated area decreased to around 150ha, which was estimated at the time of project appraisal

2) Other indicators (Cultivated Area, Collection Ratio of Water User Fee, Average Size of Land per Farmer)

1)Indicators concerning agricultural productivity

Table 2 shows the data measuring the improvement of agricultural productivity such as cultivated area, portion of cultivated area, production volume of main agricultural products and those per unit at the time of project appraisal, as well as actual achievement after the project completion.

	20	04	20	09	20	010	20	11	20	12
Indicators	Rainy Season	Dry Season								
Cultivated Area (ha) ⁹	612	169	800	407	800	415	800	150	800	165
Portion of cultivated area (%)	76	21	100	51	100	52	100	19	100	21
Production Volume of	main ag	ricultural	products	(ton/year	r)					
Rice	1,247	0	3,720	0	3,806	0	4,007	0	4,322	0
Maize	0	248	0	1,218	0	1,038	0	600	0	600
Production volume per unit (ton/ha)										
Rice	2.0	0	4.7	0	4.8	0	5.0	0	5.4	0
Maize	0	1.5	0	3.0	0	2.5	0	4.0	0	3.6

Table 2 : Data concerning the Agricultural Productivity. (Before Project Implementation and Actual achievements after Project Completion)

Source: JICA document and answer on questionnaire.

As can be seen in Table 2, while a portion of cultivated area in the rainy season was 76% at the time of appraisal (2004), it reached 100% every year after project completion. Additionally, comparing production volumes of rice and maize in 2012 with those in 2004, rice production increased 3.5 times and that of maize increased 2.4 times. Furthermore, in terms of production volume per unit, rice increased 2.7 times and maize increased 2.4 times¹⁰. As described above, it

⁹ Cultivated area refers to the cultivated area within the project target area 800ha. 612ha in 2004 includes the area of rain-fed cultivated area. ¹⁰ Increase rates are calculated by dividing the figures of 2012 by those of 2012.

can be said that this project has contributed to promoting efficient water distribution and to improving the agricultural productivity which is shown as increase of cultivated area, production volumes of rice and maize and those per unit, by implementing rehabilitation of the irrigation facilities, land levelling and technical assistance of water management. Regarding the increased rate of production volume and that of cultivated area, rate of production volume was higher than that of the cultivated area. The main reason for this could be that land levelling and equal reallocation of land was conducted in this project which had not been implemented properly in the former project, in addition to the rehabilitation of the facilities. Another reason could be the increase of income from the sales of rice, which made it possible for farmers to use fertilizer.

⁽²⁾Collection Ratio of Water User Fee

Table 3 shows the shifts of data on collection ratio of water user fee.

(Defore 1 roject implementation and 7 cetual after 1 roject completion)					
Indicator	2004	2009	2010	2011	2012
Collection Ratio of Water	10.209/	60 759/	65 200/	75 950/	85 000/
User Fee (%)	10-30%	00-7376	03-8076	/3-8370	83-9070
a					

Table 3 : Data on Collection Ratio of Water User Fee. (Before Project Implementation and Actual after Project Completion)

Source: JICA document and answer on questionnaire.

As shown in Table 3, collection ratio of water user fee largely increased from 10-30% at the time of project appraisal (2004) to 85-90% at the time of ex-post evaluation (2012). According to an interview with Lilongwe Irrigation Services Division (Lilongwe ISD)¹¹, which is one of the project's implementing agencies¹², the reasons for why the collection ratio had increased year by year were: 1) farmers became able to afford payment of water user fees, since this project contributed to increasing their incomes from rice sales as a result of activating the rice sales business through the technical assistance which is called as the "soft component activities"; 2) the system for collecting water user fees was strengthened by the soft component activities, such as the introduction of PC registration system for farmers, allocation of staff (secretary and responsible personnel), implementation of training concerning water user fee collection and improvement of the accounting system of the farmers' cooperative. In addition, according to an interview with the leaders of the farmers' cooperative, activities of the soft component enhanced the awareness of farmers regarding payment of water user fees. Considering the above, it can be judged this project has contributed significantly to the increase of collection ratio of water user

¹¹ This division was one of the divisions in Lilongwe ADD at the time of project appraisal.

¹² See "3.5.1 Institutional Aspects of Operation and Maintenance" for details.

fee.

③Indicators concerning land reallocation

In the former project, as the leaders of each village allocated land based on the administration boundaries of villages, the average size of land per farmer was uneven. This triggered dissatisfaction of farmers who had been given smaller sections of land. In addition, this inequality of land created the problem of abandoned land, as farmers who had been given large areas of land could not maintain their land. Table 4 shows the shifts of average size of land per farmer in the target area. As land was reallocated equally to all farmers through this project, the average size of land per farmer became 0.4 ha at the time of project completion¹³.

					(Unit: ha)
Village group	2004	2009	2010	2011	2012
Kafulama	0.21	0.4	0.4	0.4	0.4
Bwanari	0.20	0.4	0.4	0.4	0.4
Mchanja	0.43	0.4	0.4	0.4	0.4
Mthembanji	0.45	0.4	0.4	0.4	0.4

Table 4: Average Size of Land per Farmer in Each Group Village. (Before Project Implementation and Actual after Project Completion)

Source: JICA document and answer on questionnaire.

3.2.2 Qualitative Effects

In this survey, interviews with Lilongwe ISD, the Dedza District Irrigation Office¹⁴ (Dedza DIO), the Agricultural Extension Development Officer (AEDO)¹⁵ and farmers were conducted. In addition, a beneficiary survey¹⁶ was also implemented. Based on the data gathered, analysis of the qualitative effects expected to be achieved through this project was made as follows.

1) Improving stability of irrigation facilities against floods

Although there have been no major floods following the project's completion, it can be examined that relocation of the main canal and rehabilitation of the headworks conducted

¹⁴ It belongs to Lilongwe ISD. Refer to "3.5.1 Institutional Aspects of Operation and Maintenance" for details.

¹³ See "3.2.2 Qualitative Effects 5) Equal land distribution and improvement of land usage" for details.

¹⁵ AEDO instructs farmers in farming techniques and general irrigation techniques.

¹⁶ Questionnaire-based interviews were conducted with farmers residing in the Bwanje Valley Irrigation System during the evaluation study. The sample size of the beneficiary survey was 100 from 3 Branch Canals (BC1, BC2 and BC3). 34 were drawn from BC1, 30 from BC2 while 36 from BC3. The survey targeted the farmers who have been cultivating in the Bwanje Valley Irrigation System since before project completion (more than 8 years) and reviewed the change before and after the project.

through this project has contributed to making the irrigation facilities safer and more secure against future flooding. GOM implemented work to change the river channel through the support of a soft component. This also contributed to increasing safety against flooding. Moreover, having received trainings implemented through soft component activities, the farmers' cooperative took actions to decrease the risks of damages by floods. One example of these activities was planting vetiver grasses along the river to protect canal bank against floods. Considering this, it can be inferred that the safety of facilities against floods has been increased.



Picture 1: Relocated main canal





Picture 2: Grasses planted along the main canal, which the farmers' cooperative implemented for the protection of the bank from flood damages

Figure 1 shows farmers' satisfaction levels drawn from the beneficiary survey. The level of satisfaction was generally high among farmers, with the majority (75%) responding that they were either "very satisfied" or "satisfied" with the project. Figure 2 shows the reasons for the satisfaction of those who answered either "very satisfied" or "satisfied". It suggests that the high level of satisfaction can be largely attributed to the rehabilitation of the irrigation facilities and strengthening of water management through soft component by this project, as many respondents mentioned sufficient water supply and efficient water distribution through rehabilitated canals as the reasons for their satisfaction. On the other hand, 23% of the farmers answered "dissatisfied" or "very dissatisfied" with the project. Inefficient water distribution and inadequate water supply were raised as reasons for their dissatisfaction. Considering this, water management such as control of water gates and elimination of sand still needs to be improved in some areas.





Figure 1: Are you satisfied with the project?



3) Smooth flow of water and alleviation of farmers' burden on sediment removal work

In the previous settling basin, sediment removal work had to be manually carried out without natural flushing by gravity. Because this removal work was not implemented properly, a large amount of sediment was conveyed to the canals. This disturbed smooth flow of water and reduced canal capacity. In the new settling basin constructed by this project, sediment removal work was carried out by natural flushing. This reduced the amount of sediment and increased canal capacity. Additionally, according to interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers, it was confirmed that the farmers' burden on sediment removal had been decreased compared before the project implementation.

4) Increase of the cultivated area of rice

Land levelling, which was supposed to be conducted by Malawi side after the former project's completion, had not been completed. The level of progress of land leveling was low as only 25% of the entire land-levelling of target area had been implemented in 2004. Due to this delay in land levelling, irrigated area as well as cultivated area remained at a low level. Prior to the project's implementation, cultivated area during the rainy season had been 76% (2004); it reached 100% every year after project completion (see Table 2). According to interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers, the factors for this increase of cultivated area were 1) proper implementation of land leveling, 2) improvement of canal capacity as construction of the new settling basin reduced the amount of sediment.

5) Equal land distribution and improvement of land utilization

As shown in Table 4, 0.4ha of land was reallocated equally to each farmer. Additionally, the

percentage of cultivated area in the rainy season reached 100%, which implies the improvement of land utilization (see Table 2). Figure 3 shows the satisfaction level of farmers that was drawn from the beneficiary survey implemented through this project. The level of satisfaction was generally high among farmers, with the majority (80%) responding that they were either "very satisfied" or "satisfied"¹⁷. Figure 4 shows whether land reallocation contributed to improving agricultural productivity. Most of the respondents (80%) answered that agricultural productivity was 'largely improved' or 'improved' by this land reallocation. The above results suggest that the land reallocation implemented though this project played an important role in the better utilization of land.



Figure 3: Are you satisfied with the land reallocation implemented through the project?



[Lessons learned from land reallocation implemented through this project]

In the former project, land allocation was unequal. However, in this project, 0.4ha of land per farmer was reallocated equally. The followings are lessons learned regarding land reallocation, drawn from a review of the ways in which land allocation had been conducted in both the former project and this project.

Factors of unequal allocation of land in the former project

In the former project, no intervention to land allocation such as activities by soft component was made and land allocation work was entrusted to GOM. As a result, land was allocated unequally to farmers by Traditional Authority (TA) and the leaders of each village using the borders of each village. This could have been one of the major factors of unequal distribution¹⁸ Another factor could

¹⁷ Farmers who answered 'dissatisfied' are mostly those who had received smaller land than before by this land reallocation.

¹⁸ As the project area is customary land, Traditional authority (TA) has the land ownership. TA transfers its authority of cultivation to Group Village Head (GVH) and VH (Village Head).

be that cadastre was not well prepared and accurate data and documents of each farmer were not available at the time.

Factors of equal land reallocation in this project

1) Promoting the understanding and effective involvement of Traditional Authority (TA)

At the beginning of the soft component activities, explanation to the TA regarding the importance of land reallocation was conducted to better promote their understanding of the importance. As a result of the discussions, equal land reallocation was agreed on without considering the borders of the villages and cooperation of the TA to the project was strengthened. For example, with the help of the TA, the farmers who were not willing to accept land reallocation accepted it.

2) Cumulative participatory workshops with farmers

Through soft component activities, participatory workshops with farmers were repeatedly conducted and discussions on the importance of land reallocation were made on several occasions. These cumulative workshops, as well as the TA's persuasion, enabled securing an agreement from those farmers who had initially disagreed to land reallocation.

3) Accurate data collection and management

Through soft component activities, a new computer-based data management of farmers' information was introduced. This new system enabled managing data accurately and thus avoiding the duplication of land allocation.

4) Collaboration between the hardware side (land levelling) and the software side (land reallocation)

Since farmers would not have agreed to land reallocation without confirming that their distributed land was adequately levelled, land levelling work and land reallocation were implemented together. Finally, each agreement was made by the endorsement of farmers after confirming the levelled land in the presence of a Japanese supervisory consultant. This procedure was conducted for the entire target area (800ha). This suggests that land levelling played an important role in equal land reallocation.

6) Achievement of equal water distribution by improvement of water management capabilities

Prior to this project, the water management system had not been functioning very well and water was not being distributed equally. Through soft component activities, a water management committee (one of the organizations under farmers' cooperative) was established and had implemented proper water management taken along their plans after the project completion. Through interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers, it is confirmed that the water management capacity of the farmers' cooperative had been improved

through trainings as well as the water management manual provided by the soft component activities. On the other hand, the beneficiary survey showed that some farmers were not satisfied with water management in their areas. Therefore, regular and continuous monitoring, as well as capacity building of water management of the concerned parties need to be continued.

7) Continuous utilization of the existing main canal

As Tables 1 and 2 show, the irrigated area as well as the cultivated area of the existing main canal (210ha) reached 100%; therefore, continuous utilization of the existing main canal is confirmed.

3.3 Impact

3.3.1 Intended Impacts

At the time of project appraisal, impacts on improvement of agricultural productivity, increase of agricultural income and poverty reduction were intended to be achieved by this project. Based on the data taken from the interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers as well as the beneficiary survey, the intended impacts of this project were analyzed as follows.

1) Stable agricultural productions and improvement of production volume

Prior to project implementation, most farmers had conducted agriculture without using fertilizer or pesticide. After project completion, production volume of rice increasing along with farmers' incomes enabled them to purchase certified seeds and fertilizer. According to the interview with Lilongwe ISD, almost 90% of farmers in the target area now use fertilizers. Additionally, prior to the project, cultivation timing had not been unified across the entire target area, mainly due to the lack of irrigated water and disunion of cultivated breeds. To that end, instruction on cultivation was implemented to farmers through soft component activities. Results of the beneficiary survey show that most of the farmers (88%) responded that the timing of cultivation has now become regular. In addition, several interviewees of Lilongwe ISD, Dedza DIO and AEDO commented that water distribution became equal and stable, as a uniform cultivation period enabled the implementation of systematic irrigation.

As described above, water supply has become stable and production volume of rice and maize and those per unit have been increasing every year following project completion. Thus, it can be judged that this project has largely contributed to increasing the agricultural productivity in the target area.

2) Contribution to farmers' incomes and poverty reduction

Table 5 shows the average household income in the Bwanje Valley Irrigation Area prior to project implementation and actual income after project completion.

Table 5: Average household income in the Bwanje Valley Irrigation Area.(Before Project Implementation and Actual after Project Completion)

Unit : MK

	2004	2009	2010	2011	2012
Farmers' household	50,000	120.000	165 000	204 000	300.000
income	50,000	120,000	105,000	204,000	500,000

Source: JICA document and answer on questionnaire.

As shown in Table 5, farmers' income increased 6 times from 2004 to 2012. Since almost 70% of farmers' incomes in the target area come from rice sales, it can be said that this increase was largely attributed to the increased income from rice sales. In addition, according to the beneficiary survey, many of the respondents raised "stable water supply", "good quality of land" and "equal distribution of land" as reasons for the increase in incomes. This suggests that the land levelling, equal land reallocation and appropriate technical assistance on water management achieved by this project largely contributed to increase of farmers' incomes in the target area. Moreover, through the soft component activities, rice sales business was activated in order to fill the lack of income from water user fee. Furthermore, cooperation with OVOP¹⁹ (for example, expansion of sales channel) was promoted and the construction of a rice mill was supported through the soft component activities. At the time of ex-post evaluation, rice produced in the target area was sold at 8 markets in major cities such as Lilongwe and Blantyre. This shows that new markets have been successfully explored following project completion. In addition, as part of the rice sales promotion activities to find potential customers, the farmers' cooperative made presentations at the OVOP regional exhibition in Lilongwe (2012) and the International Trade Fair in Blantyre (2013) with the assistance of OVOP. Thus, it can be stated that the activities promoted by the soft component have been continuously implemented following project completion. Moreover, as a result of assessing the market situation accurately through the support of soft component activities, production of Kilombelo, which has high market value, increased and as a result, the income from rice sales increased²⁰.

Figure 5 shows whether the project contributed to improving the living environment of the

¹⁹ "One Village One Product" supported by JICA

²⁰ Main blends of rice produced in the Bwanje irrigation at the project appraisal time were Faya and Kilombelo. However, Faya was less popular in the market and the seeds of Faya remained unsold.

farmers, as drawn from the beneficiary survey. As seen in Figure 5, 83% of beneficiaries answered that the living standard had been improved by this project. How their living standards had been improved is shown in Figure 6. Many of the respondents and the interviewees pointed out 1) the securement of enough food, 2) purchasing of vehicles (for example, motorbikes, bicycle and oxcart) and other livingware (for examples, mattress, clothes and mobile phones) 3) improvement of housing (for example, using of iron roof), 4) better education for children and 5) an increase in livestock, as examples of improvement of living environment.



Figure 5: Has the project changed the living environment?



Figure 6: Reason(s) for answering "yes" to the question in Figure 9 (multiple answers allowed).

The above results suggest that the project has played an important role in the betterment of farmers' lives in the Bwanje irrigation area.

3.3.2 Other Impacts

1) Impacts on the Natural Environment

The District Environment Office of the Dedza District Council is in charge of monitoring the target area. Monitoring plans are prepared annually and a district meeting is held monthly in which monitoring results are shared with AEDO and engineers from Dedza DIO. According to the environmental assessment report submitted by the District Environmental Office after the project completion and site visits, no negative impact on the environment by this project was found. However, some interviewees commented that deforestation caused by farmers upstream of Namikokwe River has been progressing and has been increasing the inflow of sand, which brings a further lack of water to the irrigation facilities in the dry season. According to the Lilongwe ISD, the Ministry of Environment and Climate Change and MOAFS have been taking some actions. For example, tree planting has been conducted in order to stop deforestation. Also, building a protection wall made by some plants and changing the ridge upstream of the Namikokwe River have been implemented in order to reduce the inflow of sand to the irrigation facilities caused by the deforestation.

2) Land Acquisition and Resettlement

No land acquisition or resettlement occurred for this project, which was confirmed through

the interviews with Lilongwe ISD and site visits during the evaluation study.

(Conclusion on Effectiveness and Impact)

After the project completion, the entire Bwanje Valley Irrigation area (800ha) benefitted from the rehabilitation of the irrigation facilities by this project as planned. Also, several project effects such as an increase of production volume and production units of rice and maize and an increase of collection rate in water user fee have been confirmed. In addition, owing to the betterment of water distribution, equal land reallocation and completion of land levelling, positive impacts such as the improvement of agricultural productivity, farmers' incomes and environmental standards were seen. In view of the above, this project has largely achieved its objectives; therefore, its effectiveness is high.

3.4 Efficiency (Rating: 2)

3.4.1 Project Outputs

Table 6 shows the planned and actual outputs of the project. Concerning table 6, the project outputs, both those contributed by Japan and by Malawi were generally achieved as planned.

It was confirmed that all land levelling of 597ha (Japanese side: 419ha out of 590ha, Malawi side: 178ha out of 210ha) had been completed. Also, as described previously, the cultivated area reached 100% after the project completion, which shows that the problem of non-cultivation was solved (see Table 2).

According to an interview with the implementing agencies and the Japanese supervisory consultant, inputs by the Malawi side were implemented as planned.

Planned Outputs (At Appraisal)	Actual Outputs (At Ex-Post Evaluation)
【Contribution of the Japanese Side】 1) Rehabilitation of Headworks Rehabilitation of the following parts: ①River Slope/Bed Protection Works below	【Contribution of the Japanese Side】 All the outputs were achieved as per the plan, although there were some minor design changes.
the Downstream Apron ②Operation Bridge ③Sluiceway Gate ④Intake ⑤Conducting Wall at the Upstream	The following changes were made at the time of Detailed Design (D/D) Survey from the initial design of the Basic Design (B/D):(1) River Slope of Headworks below Downstream Apron
Sluiceway 2) Rehabilitation of Settling Basin	B/D: Width 50.0m×Length 25.0m Area 1 250 m ²
 Demolishment of the existing settling Basin Construction of the new Settling Basin 	D/D : Width50.0m×Length37.0m Area 1,850 m ²

Table 6: Planned and Actual Project Outputs

ſ	Calineant Can hait a Langeth, 21.0 m. Wilth	(1) $\mathbf{D}' = \mathbf{D} + \mathbf{D} + \mathbf{C} + $
	Sediment Conduit : Length: 31.0 m, width:	(2) River Bed Protection area of Headworks
	1.5m X 3 nos., Stope: Discharge Dinger Lengethe 25 0 m. Wildler	B/D : 4,100 m ²
	Discharge Pipe : Length: 35.0 m, width x	D/D : 3,100 m ²
	Fluch Cate \downarrow 1 0m x 1 0m x 2 nos	(3) Rehabilitation of Bank Protection at the
	Flush Gale : 1.0m x 1.0m x 5 hos.	Downstream
	Control Gate $: 1.2m \ge 0.5m \ge 3$ nos.	B/D : 3 000 m ²
	Spillway Gate : 1.0m x 1.25m x 1 no.	$D/D : 2 400 \text{ m}^2$
	3) Relocation of Main Canal	D/D : 2,700 m
	It was planned that the main canal, which was	During rehabilitation work of the headworks
	in parallel to the Namikokwe River, be	in the first phase the temporary canal was
	relocated to the mountain ridge.	excavated largely by the floods Because of
	Main Canal : Length: 5.8km, Design	this the backfilling volume of the temporary
	Discharge: 1.14 ~0.53 m ³ /s	40.000 m^3 while the original
	Branch Canal : Length: 3.0km, Design	canal became $40,000$ m, while the original plan was for 5500 m ³ Ås a result the
	Discharge: $0.33 \sim 0.18 \text{ m}^3/\text{s}$	plan was for $3,500$ in . As a fesul, the
	Tertiary Canal: Length: 0.8km	dare at the second phase
	Raising Existing Canal Height : Length:	done at the second phase.
	10.2km, Raising Height:10cm~20cm	
	Drainage Canal : Length: 4.0km, Design	
	Discharge: 0.04~0.37 m3/s	
	Canal Related Structure :	
	Gate Structure, Bifurcation, Turnout, Drop,	
	Culvert, Drainage Culvert,	
	Footbridge, Washing Basin, Field Inlet,	
	Division Box	
	Inspection Road : Length: 5.8km, width:	
	(width of Pavement 3.0m)	
	4)Land Levelling	4) Land Levelling
	(DResponsible area under Japanese	Land levelling of the entire area of 419ha
	assistance : 590ha	(within the Japanese side of 590ha) was
	(2)Levelling grade : ± 7.5 cm	Completed.
	5) Soft component Program	5) Soft component Program
	(1)Land Re-Allocation Assistance	(I)Land Re-Allocation Assistance: planned
	• Preparation of the detailed	activities were implemented
	implementation plan and standards for	⁽²⁾ Water Management Strengthening
	land re-allocation	Assistance:
	• Assistance on implementation of land	In order to make sure that the O&M system
	re-allocation and preparation of land	functioned appropriately after project
	registration list and cadastral maps	completion, improvement of the management
	² Water Management Strengthening	of farmers' cooperative was considered to be
	Assistance	necessary. Therefore, the following activities
	• Re-organization of the present water	were implemented additionally.
	management organization	• Improvement of accounting system of
	• Capacity building of water management	farmers' cooperative as one of the
	and O&M of facilities	supports for collection of water user fees
	• Establishment of new water fee collection	• Activation of rice marketing business to
	system	compensate for the shortfall of income
	(3)Flood Damage Mitigation and Renair	from water user fees
	Massuras Assistance	• Construction of rice mill and
	Aggistance for construction of home-	commencing rice mill business to
	• Assistance for construction of bypass	compensate for the shortfall of income
	canal with road of the existing main canal,	from water user fees
	river protection works and spur dike	• Introduction of maize mill machine to
	• On-the-job training for flood damage	compensate for the shortfall of income
- 1		

Preparation of manual for flood damage	from water user fees
mitigation and repair measures	③Flood Damage Mitigation and Repair
	Measures Assistance:
6)Temporary works (site office,	Planned activities were implemented. Staff of
accommodation, temporary yard) and	the farmers' cooperative was added as targets
construction and dismantling of temporary	of the technical assistance.
access road	
	Total input for the above mentioned soft
	component activities was 12.8M/M.
[Contribution of the Malawi Side]	
1)Land acquisition for construction	[Contribution of the Malawi Side]
2)Personnel and budget for land reallocation.	Planned activities were implemented. Land
acquisition of agreement from farmers on land	levelling of all 178ha of the Malawi side
re-allocation implementation of land	(210ha) was completed.
re-allocation	
2) Demonstration	
3)Personnel for implementation of the	
capacity building of water management for the	
farmers' cooperative	
4)Personnel and budget for implementation of	
the Flood Damage Mitigation and Repair of	
the existing main canal	

3.4.2. Project Inputs

3.4.2.1 Project Cost

The planned project cost was 1,038 million yen (1,033 million yen was the E/N ceiling and 5 million yen was to be supplied by the Malawi side), whereas the actual project cost was approximately 1,035 million yen (1,031 million yen was contributed by Japan and 4.37 million yen was contributed by Malawi). Thus, actual project cost was delivered mostly as planned (99% of the planned cost).

3.4.2.2 Project Period

The project period was planned to be from November 2004 to February 2008 (27 months). The actual project period of Japanese side was from November 2004 to September 2008 (34 months) and that of Malawi side was from April 2006 to March 2008, which was longer than planned (126% of the planned period). According to interview with the Japanese supervisory consultant, the reasons for this delay were as follows: 1) during construction, the temporary canal was damaged by flooding; 2) procedure for importing building materials was not smoothly effected by the Ministry of Finance of Malawi; 3) spare parts for the construction plant and equipment were not available within the country, and took time to import when needed; 4) cement happened to be unavailable within the country during the construction period.

Although the project cost was within the plan, the project period was slightly exceeded; therefore, efficiency of the project was fair.



Picture 3 : Newly Constructed Settling Basin



Picture 4: Leveled land

3.5 Sustainability (Rating: 2)

3.5.1 Institutional Aspects of Operation and Maintenance

Due to the reorganization of government ministries in 2009, the ministries in charge of O&M of this irrigation facilities at the time of ex-post evaluation were the Ministry of Water Development and Irrigation (MOWDI) and MOAFS. However, since most of the staff who had been involved in this project moved from MOAFS to MOWDI, MOWDI was the main executing agency²¹. Lilongwe ISD under MOWDI was mainly in charge of O&M of the irrigation facilities. Instructed by Lilongwe ISD, engineers in Dedza DIO conducted regular monitoring of the irrigation facilities and technical assistance. A new Assistant Irrigation Officer, who is specifically in charge of the Bwanje Valley Irrigation area and surrounding area, was allocated in Dedza DIO in May 2013. It is confirmed that this officer often visits and monitors the irrigation facilities.

Dedza DADO, under MOAFS, allocated one project manager and three AEDO at the Project Office after the project's completion. These staff have instructed farmers in general agricultural and irrigation techniques. However, two AEDO positions were vacant at the time of ex-post evaluation. As vacancy of AEDO positions was not only a problem in this target area but one throughout the country²², MOAFS introduced the "Lead Farmers System" in which potential farmers who might be able to take a role of AEDO are selected from each village and trained with the purpose of providing services which, ordinarily, are provided by the AEDO. This

²¹ Irrigation Service Division of Lilongwe ADD which was under the original executing agency (MOAFS) was separated from MOAFS and moved to MOWDI. Therefore, the department itself became Lilongwe ISD under MOWDI and the staff was not changed.

²² Almost 40% of AEDO is vacant at the time of ex-post evaluation all over the country.

system also aims to improve the ownership of farmers concerning O&M of their irrigation systems. In the target area, this "Lead Farmers System" is planned to be introduced in the near future and is expected to create farmers who can contribute to filling in the services which is not delivered because of two AEDO vacancies. Additionally, according to the interviews with implementing agencies and AEDO, farmers in the target area were well trained by AEDO and improved their ability of O&M. Therefore, they insisted that the AEDO vacancy was currently not a major problem. However, considering that there were 2,067 cooperative members in the target area, there might be the possibility that the current 2 AEDO cannot take full responsibility for continuous assistance for improvement of O&M, water management and agricultural productions. Therefore, it is desirable for GOM to assist this "Lead Farmers System" function well and promote strong cooperation between AEDO and the engineers of Dedza DIO.

Following project completion, routine maintenance of the irrigation facilities was implemented by the farmers' cooperative under the direction of the Project Office and Dedza DIO. The total number of the farmers' cooperative members was 2,067 at the time of ex-post evaluation. Leaders of the farmers' cooperative drew up a monthly O&M plan and monitored the facilities three times a month.

GOM has been promoting a reorganization of institutional arrangement in irrigation systems all over the country by separating the farmers' cooperative to two organizations: "Water Users Association (WUA)" and the "farmers' cooperative". WUA is in charge of the O&M of irrigation facilities and water management, whereas the farmers' cooperative specializes in selling agricultural products. These two organizations are separated in terms of financial aspects (see Table 7). The purpose of this separation is 1) enhancing the transparency of operations by making an apparent role division between O&M of the irrigation system and the sales of agricultural products; 2) enhancing the efficiency of O&M and improving the collection ratio of water user fees and annual fees by establishing an organization which specializes in the O&M of the irrigation facilities.

At the target area, the above mentioned reorganization of institutional arrangement has been implemented since 2011 and the new system was established after the official election conducted in May 2013. Prior to this reorganization of institutional arrangement, sixty-five representatives from the farmers' cooperative had been received trainings (such as operational and financial roles related to the WUA and the farmers' cooperative) implemented by GOM. After receiving this training, the representatives conducted trainings to pass on the information they attained to the farmers at each village. Approximately 1,600 farmers (75% of all the farmers in the target area) have already received training. Regarding the management of WUA,

some interviewees from implementing agencies and AEDO commented that there should not be any problems concerning this, as 36 representatives selected through the election in May 2013 had already taken the above mentioned training by GOM. The interviewees also mentioned that the trainings conducted at each village have promoted the understanding of farmers about reorganization of institutional arrangement. Regarding the farmers' cooperative, it belongs to the Ministry of Industry and Trade (MOIT), which monitors and supervises the farmers' cooperative through the Dedza OVOP District Office.

	WUA	Farmers' cooperative
Role	O&M of irrigation system and assistance for water management techniques	General operations for selling agricultural productions ²³
Financial source	Water user fees, annual fees and penalties, etc.	Income from selling fertilizer ²⁴ /rice, rice and maize milling and share, etc.
Use	Cost for implementation of O&M (repair cost, labour cost, etc.)	Costs for selling agricultural products (transportation fees and sales promotion fees, etc.)
Sub-organ	MOWDI	MOIT

Table 7: Roles and financial sources of WUA and Farmers' cooperative.

According to the reorganization of institutional arrangements, multiple Ministries (MOWDI, MOAFS and MOIT) are involved in the operation of the irrigation system. Regular information sharing was being implemented among the agencies concerned at the time of ex-post evaluation. However, this information sharing is limited to the actions to be taken when problems arose; cooperative planning and monitoring of this irrigation system among the concerning agencies are not being conducted. Considering that this irrigation system is the largest irrigation system in Malawi and that the new organizations (WUA & the farmers' cooperative) have only just been established, active involvement and cooperation of the concerning agencies is considered important for the strengthening of an efficient O&M structure.

²³ Farmers sell the agricultural products to the farmers' cooperative and farmers' cooperative sell those products to the market.

²⁴ Farmers' cooperative purchase fertilizer wholesale and sell them to farmers.



Figure 7: Agencies involved and O&M structure of the irrigation system

3.5.2 Technical Aspects of Operation and Maintenance

According to interviews with leaders of the farmers' cooperative and the beneficiary survey, the trainings concerning O&M, water management, water user fee collection and mitigation of flood damage implemented through soft component activities improved farmers' capacity for the above mentioned areas. Additionally, even after project completion, many trainings regarding irrigation techniques, O&M, farming and organizational management were conducted for the farmers' cooperative. Twenty training sessions (5 categories) were conducted for the farmers' cooperative from project completion to the time of ex-post evaluation and a total of 204 individuals participated in these trainings. In addition, as part of the soft component assistance, a rice market survey was conducted. Based on this survey, farmers were instructed to crop mainly Kilombelo, which has high demand in the market. This increased the production volume of Kilombelo in the target area. Moreover, as a result of promoting cooperation between the farmers' cooperative and OVOP through soft component activities, the farmers' cooperative also explored new markets and participated in trade fairs with assistance from OVOP following project completion. Thus, markets for rice have been broadened. As described above, it is confirmed that capacity of the farmers' cooperative regarding the rice production and sales was improved. Furthermore, staff of the implementing agencies participated in the trainings on irrigation management system, farmer organization on water management, O&M of irrigation facilities (all presented by JICA, 2012) and trainings on community based irrigation management were conducted by grass roots technical cooperation of the Miyagi prefecture

(2011 and 2012). According to the interviews with MOWDI and Lilongwe ISD, these trainings have contributed to improving irrigation and water management ability and raising awareness of the importance of O&M of the facilities.

Dedza DIO and leaders of the farmers' cooperative mentioned that the latter is able to conduct basic repair of the canal through soft component activities. They also commented that the manuals on water management and O&M provided by the soft component are being efficiently used. However, as mentioned previously, results of the beneficiary survey shows that water management is still not adequately implemented in some areas in the target area. Therefore, continuous monitoring by Dedza DIO and AEDO is necessary. Additionally, strengthening WUA's water management ability is considered to be important for the future.

3.5.3 Financial Aspects of Operation and Maintenance

Table 8 shows the O&M budgets of the Project Office and the farmers' cooperative for the past four years.

				(Unit : MK)
	2009	2010	2011	2012
Project office	330,000	360,000	360,000	400,000
Farmers' Cooperative	40,100	315,210	N/A	284,720

Table 8: O&M budgets of the Project Office and the farmers' cooperative.

Source: Answer on questionnaire.

O&M budget of the Project Office was allocated from Dedza DADO and used for technical assistance and monitoring of farmers. On the other hand, financial sources for O&M budget of the farmers' cooperative were water user fees, annual fees, penalties from cooperative members and income from rice sales and milling. These were used for 1) O&M of the facilities; 2) salaries for a secretary, water guards and rice mill operators who farmers' cooperative employ; 3) fuel and light expenses of the rice mill, etc. Major repairs, which the farmers' cooperative is not able to handle itself, is supposed to be conducted by GOM.

According to the leaders of the farmers' cooperative and AEDO, O&M budget of the farmers' cooperative is currently not lacking resources. Under the new O&M system, the main financial resources for O&M budgets will come only from water user fees, annual fees and penalties from members. However, the collection ratio of water user fees has been increasing year by year upto 90% currently (see Table 3). Also, both the prices of water user fees and annual fees were increased in 2013, as the market price of rice doubled. In addition, WUA specializes in collecting water user fees and annual fees; as such, collection of these fees is expected to be

strengthened. Henceforth, it is necessary that WUA pays more attention to increasing the collection ratio of water user fees and annual fees so as to secure O&M budgets for the irrigation facilities.

On the other hand, regarding farmers' cooperative management, cooperative now purchases rice only from 50 % of farmers due to the lack of cash. If the rice sales business becomes more activated, positive impacts such as increase of farmers' income as well as improvement of collection ratio of water user fees could be expected. One business manager was allocated by assistance of NGO²⁵ in May 2013 at the project office and was supposed to instruct the farmers' cooperative. However, the concerned persons²⁶ do not fully understand the roles of this business manager. Therefore, it is considered to be important that staff of the concerning agencies as well as the cooperative members share common understanding on the role of this manager clearly. It is also desirable for MOIT to instruct farmers' cooperative for the effective management and assist it from the financial aspects.

3.5.4 Current Status of Operation and Maintenance

No problems were observed through the field study in the status of maintenance of the headworks, settling basin, main and branch canals and drainage canal. The facilities are being utilized properly. Concerning the maintenance of headworks and settling basin, water guards employed by the farmers' cooperative are in charge of controlling the gate of the headworks, checking and controlling water level, flushing out sediments, removing debris under the supervision of farmers' cooperative. With regard to the new main canal and branch canals, two representatives from each branch canal are in charge of checking water level, cleaning the canal and repairing breaches. For the tertiary canal and drainage canal, each farmer has been allocated an area to clean and the farmer's name is marked on the side of the canal (see Picture 5)

Some problems have been observed in terms of the technical aspects of water management and the financial aspect of the farmers' cooperative; therefore, sustainability of the project's effect is fair.

 ²⁵ Interchurch Organization for Development Cooperation
 ²⁶ MOIWD, Lilongwe ISD, Dedza DOI, AEDO etc.



Picture 5 : Tertiary canal in which each farmer's name is marked



Picture 6 : Water guard controlling the gate of settling basin

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

In the Bwanje Valley Irrigation area, the target area of this project (the target area), headworks, irrigation and drainage canals, inspection roads and water supply boreholes were constructed from 1997 to 1999 under Grant Aid from the Government of Japan (GOJ). This grant aid project "Bwanje Valley Irrigation Development Project (the former project)" aimed at the development of irrigation of an area of 800 ha. However, the project's purpose as envisaged was not achieved since the irrigation facilities were damaged due to frequent floods. As a result, this project was implemented with the overall goal of increasing agricultural productivity in the target area. Under this project, rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management were conducted. The objectives of this project were to mitigate the risks against future floods in the target area which had been damaged by previous floods, to restore the function of the irrigation facilities damaged by floods and to create a stable irrigation water supply to this system. Both at the time of project appraisal and ex-post evaluation, the project was consistent with the agricultural sector development policies and the needs of the irrigation development of the Republic of Malawi (Malawi). Thus, the relevance of this project was high. As a result of the rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management, the irrigated area reached the target level of 800ha. In addition, compared with the time of project appraisal, rice production increased 3.5 times after project completion. This suggests that the project has contributed to increasing the agricultural productivity in the target area. Furthermore, it is confirmed that farmers in the target area are highly satisfied with the project, according to the beneficiary survey. Therefore, effectiveness and impacts of the project is high. On the other hand, the efficiency of the project is fair, because project period was longer

than planned, while the project cost was within the plan. Although no major problems were observed in the institutional aspect of Operation and Maintenance (O&M) carried out by the implementing agency, there were some concerns about the technical aspects of water management and the financial aspects of farmers' cooperative. Thus, the sustainability of this project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agencies

■ As three ministries (MOWDI, MOAFS, MOIT) are involved in the irrigation facilities, it is desirable to promote more active information sharing, to clarify the roles of each ministry, and thus to strengthen cooperation among the agencies concerned in order for the new management system to function effectively.

■ No major problems regarding the reorganization of institutional arrangement have been found since WUA and the farmers' cooperative have just started to function. However, it is important to establish a strong relationship between these two organizations so as to achieve effective and efficient utilization of the irrigation facilities. In addition, although quite a lot of farmers (75% of total members) received trainings on reorganization of institutional arrangement, it is desired that the implementing agencies promote further understanding of farmers by utilizing the opportunities of village meetings.

■ Vacancy of AEDO positions has not been a major problem to date, because farmers received adequate technical assistance and acquired adequate skills. However, in order to continuously instruct and monitor 2,067 farmers in farming and irrigation, it is important to introduce the "Lead Farmers System" as soon as possible. Also, once this has been introduced, the implementing agencies need to regularly monitor to make it function well.

■ According to interviews with some concerning parties as well as results of the beneficiary survey, it was found that water management and daily maintenance was not conducted adequately in some areas. Therefore, it could be necessary to implement regular monitoring and training continuously. In addition, the water management ability of WUA and farmers should be continued to be improved. Moreover, awareness raising on the importance of regular and daily maintenance is required to be implemented in order to maintain the irrigation facilities as long as possible.

■ The main financial sources of WUA are water user fees, annual fees and penalties. Therefore, it should be necessary to improve the collection ratio of water user fees further and strengthen

planning and management skills of the O&M budget. The implementing agencies have indicated a plan to conduct training to strengthen these skills in WUA. It is suggested that this training be implemented as soon as possible in order for WUA to function efficiently. Monitoring and follow-up after training should also be implemented.

■ In order for the farmers' cooperative to function more actively, it is desirable to clarify the role of the business manager to the concerning parties as well as to farmers. MOIT also needs to instruct and support the farmers' cooperative more actively to improve efficient management.

■ As deforestation upstream of Namikokwe River is a concern in terms of serious damage it may bring to the irrigation facilities, activities to protect the irrigation facilities from these damages should be continued. In addition, raising awareness among farmers who cut down the trees is important.

4.3 Lessons Learned

In this project, both irrigation area and cultivated area achieved the targeted level. The project showed high impacts in terms of improvement of agricultural productivity and farmers' incomes. The following factors were considered to contribute to this success. Firstly, this project was carefully planned, based on the accurate survey of factors that prevented the intended effects in the former project. Secondly, based on the above mentioned analysis, sufficient consideration of land levelling and land reallocation was given in addition to the rehabilitation of facilities, in other words, an efficient integration of software and hardware components was made. One of the factors which made these both components function well is that adequate explanation of the project to farmers increased the transparency of this project. Another factor is that close communication between the implementing agencies and the Japanese supervisory consultant promoted active involvement of the implementing agencies. To sum up, lessons learnt through this project were: implementation of accurate pre-survey; comprehensive assistance from hardware and software angles; promotion of understanding among farmers as well as the involvement of the implementing agencies.