

0. Summary

The objective of this project is to increase agricultural production and productivity by constructing irrigation and related facilities, conducting farmland development and the agricultural extension services program in West Sumatra and Jambi Provinces in Sumatra Island, and thereby contribute to the maintenance of self-sufficiency in food, increases in farmers’ incomes, and improvement of their living standard.

The project is consistent with the purpose of the national development and agricultural sector development plans of Indonesia that attach importance to holistic agricultural development as a base for economic development coupled with the food security. It is also consistent with the total national development policy and meets the nation’s development needs. It has a partial problem, however, in its project formulation which placed too much emphasis on rice production. Therefore the project relevancy is moderate. Efficiency of the project is also moderate due to implementation delays; however, the effectiveness and impact are high in meeting agricultural as well as other comprehensive regional water demand by creating multipurpose water resources and contributing to the improvement of people’s living standard through increases in their incomes and the economic and social development of the region. Though some problems have been observed in financial sufficiency for the facilities’ operation and maintenance as well as in maintenance conditions of the tertiary canals, sustainability of the project is fair.

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

1. Project Description



Project Location



Completed Batang Hari Weir

1.1 Background

The Batang Hari River rises at the Highlands of Minan Kabau of the West Sumatra Province, having a total length of 800km with its catchment area of about 5 million hectare, which is the second largest in Indonesia. Having commenced in the Dutch colonial era, a transmigration policy, to remove people in densely populated Java and Bali to outer islands, has been consistently followed since independence in 1945. At the start of the national first five-year plan (1969 ~ 1973), the government accelerated its implementation. The Sumatra region is one of the major absorbers, and Batang Hari region has been also receiving a number of Javanese farmers.

This project was initially planned to accommodate migrants under the relocation program from the site of Wonogiri Dam in Central Java, which was constructed under Japan's ODA loan assistance in 1981. The Sitiung region which was selected for this project site is located at the right bank of the upstream Batang Hari River stretching across West Sumatra Province into adjacent Jambi



Flow of Batang Hari River Mainstream

Province at an average elevation of 70 ~ 100m. The region accepted about 4,000 households from Wonogiri until 1988 and about 3,000 households from other areas. As part of the water resources policy for the approximately 3,000 hectares of rain-fed paddy fields allocated to the migrants, a pump station to directly draw Batang Hari River water was installed under World Bank financing, and in addition three units of weirs were constructed at three small tributaries, the Palangko, Piruko and Siat streams. However mechanical troubles occurring in three out of the six installed pumping-up facilities, coupled with the extreme water flow decrease of the three tributaries in the dry seasons resulted in serious irrigation water scarcity in the settlements.

To break through this situation, a 1980s era plot to construct a weir at the mainstream of Batang Hari River was reconsidered and crystallized into this project. The Project was to supply irrigation water throughout the planned region as a whole with water resources from the newly constructed Batang Hari Weir and three existing tributary weirs based on the feasibility study conducted in 1992 by the Indonesian government, "Batang Hari Weir and Irrigation Development Project." The first Japanese ODA loan was provided in November 1993 for detailed study and design-engineering services prior to the project. Under such a background, this project was planned to address the national policy to efficiently use the existing irrigation facilities and increase the irrigation areas for the purpose of self-sufficiency in rice and other food crops in Indonesia.

1.2 Project Outline

The objective of this project is to increase agricultural production and productivity by constructing irrigation and related facilities, conducting farmland development and the agricultural extension services program in West Sumatra and Jambi Provinces in Sumatra Island, thereby contributing to maintenance of self-sufficiency in food, increases of farmers' incomes, and improvement of their living standard.

Approved Amount / Disbursed Amount	(E/S) 676 million yen (I) 6,050 million yen (II) 7,639 million yen (Total) 14,365million yen / (E/S) 483 million yen (I) 6,024 million yen (II) 6,351 million yen (Total) 12,858 million yen
Exchange of Notes Date / Loan Agreement Signing Date	(E/S) October, 1993 (I) December, 1996 (II) March, 2001 / (E/S) November, 1993 (I) December, 1996 (II) July, 2001
Terms and Conditions	(E/S) Interest Rate: 2.6%, Repayment Period: 30 years (Grace Period: 10 years) Procurement: Partially Untied (I) Interest Rate: 2.7% (For Consulting Service Portion: 2.3 %), Repayment Period: 30 years (Grace Period: 10 years), Procurement: General Untied (II) Interest Rate 1.8% (For Consulting Service: 0.75%), Repayment Period 30 years (Grace Period: 10 years), Procurement: Compound
Borrower / Executing Agency	(E/S) Republic of Indonesia / Directorate General of Water Resources, Ministry of Public Works (I)(II) Republic of Indonesia / Directorate General of Water Resources, Ministry of Public Works/ Directorate General of Food Crops, Ministry of Agriculture
Final Disbursement Date	(E/S) December 1999 (I) December 2002 (II) October 2009
Main Contractor (Over 1 billion yen)	(I) PT.Batanghari Perdana, PT. Pembangunan Perumahan (II) PT. Nindya Karya, PT. Hutama Karya, PT. Waskita Karya, PT Sac Nusantara (all Indonesia)
Main Consultant (Over 100 million yen)	(E/S) Nippon Koei (Japan) (I) Nippon Koei (II) Nippon Koei (Japan), PT. Wiratman & Associates (Indonesia), PT. Mettana Engineering Consultant (Indonesia), PT. Virama Karya (Indonesia), PT. Trans Intra Asia (Indonesia)
Feasibility Studies, etc.	Feasibility Study for Sungai Dareh, Sitiung Irrigation Project (August 1979, World Bank) Sungai Dareh Sitiung Irrigation Project Integrated Rice Rubber Study (July 1980, World Bank)

	Updating Feasibility Study Bendung Batang Hari serta Pengembangan Irigasinya (1992, Government of Indonesia)
Related Projects	“Survey for Maximum Utilization of Irrigation Water in the Republic of Indonesia” (2012, JICA)

2. Outline of the Evaluation Study

2.1 External Evaluator

Masami Sugimoto, Shinko Overseas Management Consulting, Inc.

2.2 Duration of Evaluation Study

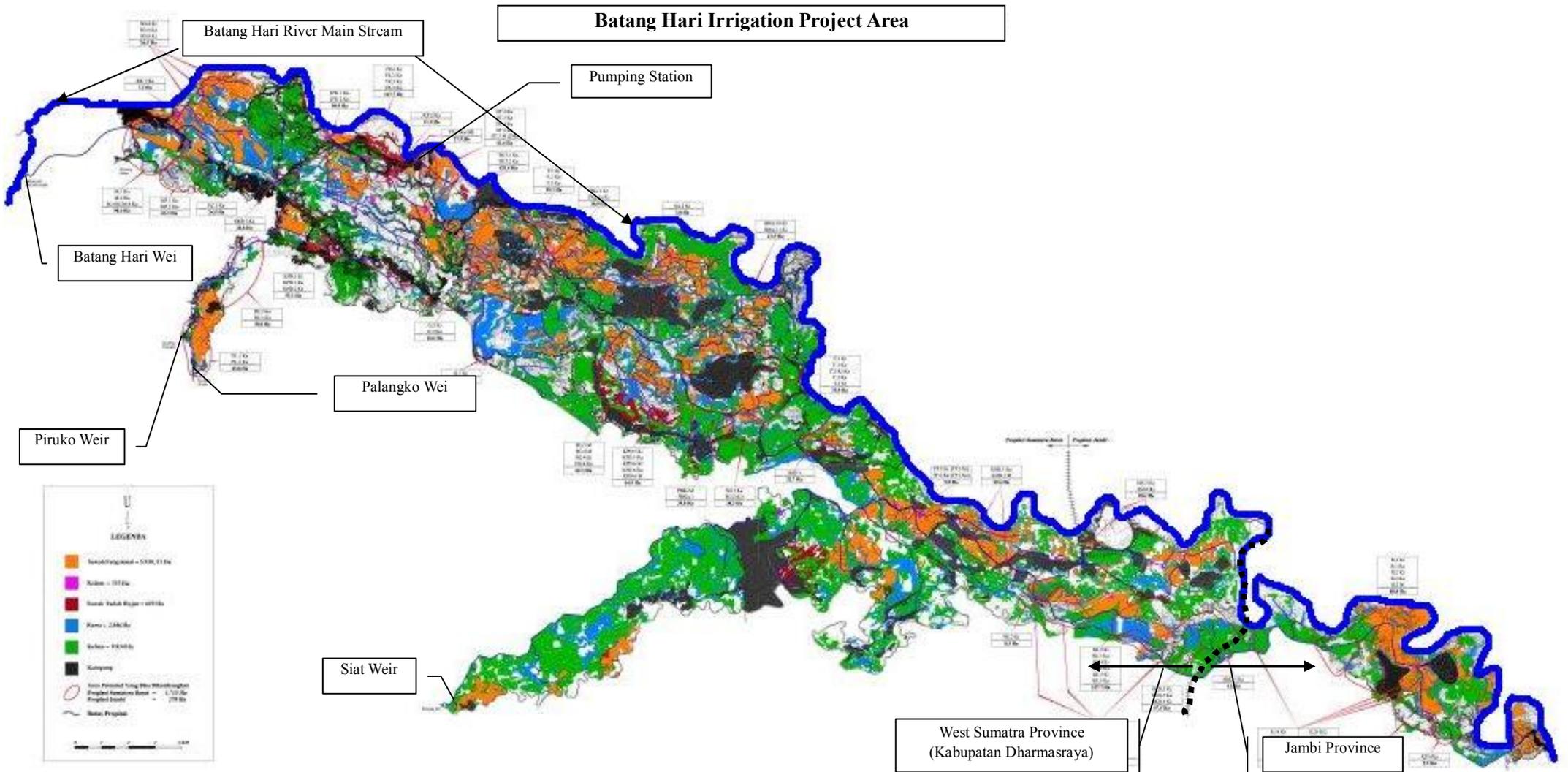
Duration of Evaluation Study: September 2011 ~ October 2011

Duration of the Field Study: January 15 ~ 28, 2012, March 24 ~ April 1, 2012

2.3 Constraints during the Evaluation Study

- 1) The project was implemented under three consecutive ODA loans initiated by the Engineering Services (E/S) Loan. However, its record, including the cost information, was not kept by the implementing agency; therefore nothing about that portion could be captured.
- 2) No operation and effect indicators of relevant agricultural production are available after project completion for the project region. What are available are the kabupaten or district-based BPS (Badan Pusat Statistik: Statistics Indonesia) statistics originated by the Agricultural Office of Kabupaten (District) Government which can not be consistently compared with the ones before the project completion. In addition, Kabupaten Dharmasraya of West Sumatra Province, to which the major part of the project area belongs, is a new municipality born in January 2004 as the region of the Batang Hari Irrigation project and the adjacent area separated from Kabupaten Sawahlunto and Sijunjung; therefore, consistent BPS Kabupaten statistics, including agricultural data, exist only after the year 2004, which prevents their quantitative comparison with previous statistics.
- 3) The water supply that became available to the project region, mainly located in Kabupaten Dharmasraya, West Sumatra Province, is used not only for agricultural production but is eventually used to satisfy a wider range of regional water demands, contributing to the economic and social development. However, the initial project purpose was limited mainly to the rice production, and no operation and effect indicators have been taken, other than rice-related items, to provide quantitative information on the project’s other realized effects and impacts.¹

¹ Performance indicators set out in the study entitled “Establishment of Performance Monitoring Indicators and Re-evaluation of Economic Viability” (former JBIC: Japan Bank for International Cooperation, October, 2000) are also rice-related ones. The economic viability of the project was reviewed by means of EIRR (Economic Internal Rate of Return) (cf. Section 3.4.3 Internal Rate of Return (IRR) (for reference))



3. Evaluation Results (Rating: C²)

3.1 Relevance (Rating: ②³)

3.1.1 Relevance with the Development Plan of Indonesia

3.1.1.1 Relevance at Appraisal

The sixth Five-year Development Plan of Indonesia (REPELITA VI, 1994/5~1998/9) set a purpose, among others, of growth and diversification of agricultural production with quality improvement and productivity increases, aiming at improving the living standard of farmers' society and emphasizing the importance of expansion of total irrigation capacity to achieve it. The Five-year National Development Plan (PROPENAS, 2000~2004), which was the succeeding plan of REPELITA after the economic crisis in 1998, aimed at "beating poverty and satisfying people's basic human needs." It emphasized as important policy measures the increase of agricultural production, agricultural diversification to meet the demand of agro-industries to increase farmers' incomes, among which expansion of rice and other food crops production and diversification of plantation products were attracting focused importance. To achieve those targets, irrigation development was going to proceed to satisfy increasing agricultural water demand by implementing the "Water Resources Development and Utilization Program."

3.1.1.2 Relevance at Ex-Post Evaluation

The 20-year long-term national development plan (RPJP, 2005~2025) formulated in 2005 sets out policy targets to (1) maintain 90% rice self-sufficiency at the minimum, (2) increase animal protein ingestion, (3) diversify the food consumption structure to alleviate excessive dependence on rice; it also makes much of the comprehensive development of the agricultural sector in a broad sense (including food and plantation crops, fishery and forestry) as a basis for economic development coupled with the food security requirement. Also, in its second phase, the National Medium-term Development Plan (RPJMN, 2010~2014), stresses the activation of the consolidated sector encompassing agriculture, fishery and forestry (PPK Sector) together with the food security. On the other hand, the Long-term Agricultural Development Plan (2005~2025) advocates the "creation of household-based agricultural industry" as one of the twelve policy directions; and for fishery, it encourages and supports domestic aquaculture in line with PNPM Mandiri, the central sub-program of the poverty alleviation national program entitled "National Program for Community Empowerment (PNPM)." The government has been conducting "Minakera" and "Mina Padi" programs⁴ within that framework throughout the

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

³ ③: High, ②: Fair, ①: Low

⁴ "Mina" and "Kena" mean "Aquaculture" and "Non-farm land including "Pekarangan <home garden>" respectively in Javanese. "Padi" is "Paddy" in English. Therefore "Minakera" and "Mina Padi" is the promotion of domestic aquaculture in vacant plots of farm households. The kabupaten government of Dharmasraya is also actively con-

country. This policy framework is considered development support for agro-forestry⁵, which consolidates agriculture, forestry, fishery and animal husbandry.

It can be concluded that the project is consistent with the development policies of Indonesia, both at appraisal and ex-post evaluation.

3.1.2 Consistency with the Development Needs of Indonesia

3.1.2.1 Consistency at Appraisal

According to the “Study for Program Formation of Nationwide Irrigation Development” (1993) by JICA, national rice consumption was estimated to total 66,232 thousand ton by 2018, and to self-satisfy that demand, rice production would need increase 15,232 thousand ton by then through continuous irrigation development, strengthened provision of producers’ goods, and dissemination of agricultural technology. From the regional perspective, the total population of West Sumatra Province was about 4.3 million with the annual rate of growth at 1.3%, while the share of agriculture was higher than 40% of the GRDP (Gross Regional Domestic Products). West Sumatra Province was supplying other adjacent provinces with 8 million tons of rice. Its position as an important domestic rice supplier necessitates the Province’s effort to continuously increase its rice production to meet said demand.

Since 1976, a total of 7,000 households from Java Island had transmigrated to the projected irrigation area. However the available irrigated area for rice production was limited to only 4,983ha, about one third of the 12,650ha which was potentially irrigable, forcing migrants to resort to unwilling cultivation of rubber and cassava instead, which were possible with less water. The low unit rice yield also required intensive effort for irrigation development to raise the rice production and productivity by a large extent. The projected irrigation area was designated to cope with the relocation urged by the Wonogiri Irrigation Project in Java Island, therefore, the necessity of developing irrigation to arrange farmland for the coming migrants was especially urgent.

3.1.2.2 Consistency at Ex-post Evaluation

Although the initial plan was mainly targeted to cope with receiving transmigration of Java farmers caused by the construction of the Wonogiri Multipurpose Dam, as a newly developed area after accepting the transmigration, it came to encounter multiple water demands not only for rice production, as will be discussed in the following section of “Effectiveness and Impact.”

ducting organization of fish farming groups which utilize water resources from this project with technical guidance and financial support.

⁵ Though various definitions are prevailing, it is defined here as a land use or production system combining agriculture, stock farming, forestry and aquaculture from many angles centering around crop production. (cf. “Symposium on Agro-forestry: Significance and possibility for sustainable regional and global development (Japanese)” Ministry of Foreign Affairs, Japan http://www.mofa.go.jp/mofaj/area/latinamerica/agroforestry_gs.html)

Consequently the project turned out to satisfy higher-level regional development needs as comprehensive water resource facility rather than those solely for rice production.

Kabupaten Dharmasraya, which is the main district of the project area, has much expected of it as a selected priority area for developing fish farming to supply animal protein for food consumption as promoted by the government, in addition to rice and other food crops. The development need of this project to construct a leading facility to supply water for that purpose is significant from the viewpoint of the food security issue.

3.1.3 Relevance with Japan's ODA Policy

Japan's Medium-term Policy on Official Development Assistance (ODA) 1999 enacted based on the ODA Charter in 1992 announces in the section for "Responding to Global Issues (3) Food," standing on the objective to achieve global food security agreed upon in the World Food Summit 1996, that it is important for poverty alleviation and self-sustained development to support the food-agriculture sector and rural development, and it expresses an intention to support irrigation development and other agricultural infrastructure improvement. The operational policy for implementing ODA of the former JBIC (Japan Bank for International Cooperation) also listed the social and economic infrastructure development as an integral area for assistance to Indonesia and placed agriculture as an important pillar in its country assistance policy (September 2000).

3.1.4 Summary of Relevance

The project is to support the national policy of Indonesia for agricultural and national economic development, emphasizing sustained food security and diversification of food consumption and attempts to cope with multiple water demands of the newly developed project region. From that aspect, relevance of the project can be judged high at the time of ex-post evaluation. As for the rice self-sufficiency in the context of the food security, the following Table 1 shows the recent situation annually.

Table 1: Annual Trend of Rice Self-Sufficiency in Indonesia

(Unit: 1,000 ton in Rough Rice)

	2007	2008	2009	2010	2011
Production	37,000	38,310	36,370	36,900	37,600
Consumption	36,350	37,100	38,000	38,850	39,140
Import	350	250	1,150	1,750	400
Production / Consumption	102%	103%	96%	95%	96%

Source: "World Markets and Trade," USDA (US Department of Agriculture)

From the above fact that rice self-sufficiency has been maintained at a point exceeding the targeted national minimum of 90% by a good margin, the rice production increase required from the viewpoint of food security became less significant in Indonesia as a whole compared to its two other RPJP objectives specified in section 3.1.1.2. Additionally, rice production in West Sumatra Province only accounts for 3.3% of the total in Indonesia, of which the share of Kabupaten Dharmasraya, to which the major part of the project area belongs, is minimal at 2.6% (0.9% in Indonesia total). Therefore the influence of this project on the national rice self-sufficiency of Indonesia turns out to be insignificant.

In the above context, the significance of this project should be regarded as the creation of the water resources to satisfy the regional multi-purpose water demands. Although this project was initiated to meet the requirement for preparing a settlement to receive Java rice farmers, the original project design as only for rice irrigation facilities was hardly relevant. As has been discussed, therefore, it is considered appropriate to have considerably reduced its originally targeted irrigation area (cf. Table 2) and sought and promoted other water uses than rice irrigation⁶. However, discussions between the Indonesian government and JICA and consequent reconsideration had not been satisfactorily made on such issues as the change in project needs during the project implementation, partial correction of the project purpose in accordance with the diversified project needs, and establishment of an updated effect and impact monitoring system. The above mentioned issues should have been dealt with in the project supervision during the implementation and reviewed to adjust the project precisely to the updated external conditions.

It was judged inappropriate to have fixed the project purpose to supply irrigation water only for rice production and never properly reviewed the prevailing conditions. Therefore the project was partly irrelevant with development needs, and its relevancy is moderate.

3.2 Effectiveness⁷ (Rating: ③)

As stated in Section 3.1.2, the purpose of this project is to increase production and productivity of rice and other agricultural products, and thereby contribute to the increase of farmers' income and their living standard. It was also confirmed in Section 3.1.1.2 that the current Indonesian long-term (RPJP 2005~2025) and medium-term (RPJMN 2010~2014) development plans

⁶ There have been several discussions and actions taken in that direction such as, among others, the recommendations of the Mid-term Review in 2007 by former JBIC (Japan Bank for International Cooperation); and agreement between the Ministry of Public Works and Kabupaten Dharmasraya on diversified use of surplus water for production of clean water, aquaculture, mini-hydro electric generation, etc. in 2010 and JICA's "Survey for Maximum Utilization of Irrigation Water in the Republic of Indonesia" in 2012. This Ex-post evaluation takes an aggressive stance that the initial perspective limiting its scope to mere rice production was not realistic and more effective uses should be actively sought regarding the purpose of this project as overall water resources to meet various water needs prevailing in the region, rather than an inactive stance to passively consider other uses of the redundant water because the demand for paddy irrigation had shrunken.

⁷ Sub-rating for Effectiveness is to be put with consideration of Impact

regard the agricultural sector in the broader sense as a wide-range primary industry involving food and estate products, fishery and forestry. Section 2.3 3) above mentioned that the project management during the implementation phase included monitoring by means of operation and effect indicators concentrating only on rice production. However, the project's effects and impacts widely encompass an extended scope of non-rice agricultural production and other economic and social spheres, and they have been contributing to the project's higher objectives represented by increases in the regional people's income and general standard of living by way of different scenario that had not been originally expected. Therefore, the ex-post evaluation also takes those factors to measure project's effect and impacts.

3.2.1 Quantitative Effects (Operation and Effect Indicators)

The project almost realized the total irrigable area as was planned. However, due to the economic, social, technical institutional and administrative constraints listed in Section 3.4.1 1 for rice irrigation, the completed length of the tertiary canals and the total area of land development were only 36% of the planned. Consequently, both the total rice cultivation area and production resulted in considerably behind the targeted level at the project appraisal.

Table 2: Operation Indicators

Indicators	(1) Baseline (1996)	(2) Target at Appraisal (2007)	(3) Amended Target (2011) (Note 1)	(4) Realized Performance (2011)
Total Irrigable Area (ha) (Note 2)	-	18,733	18,936	18,936
Realized Irriga- tion Area (ha)	(Rainy Season)4,983 (Dry Season)1,250	18,733	6,682	6,779

(Source) (1) (2) JICA appraisal documents, (3) JICA internal documents, (4) Dinas Pertanian (Kabupaten)

(Note 1) It was recognized during the project implementation that the targeted irrigation area of the initial plan would not be achievable due to the various adverse factors listed in Section 3.4.1, 1 below, and became inevitable to drastically reduce the original figure. ("Mid-term Review Report" 2007, JICA) The amended figure is shown in JICA internal documents.

(Note2) Total area of irrigable paddy fields realized by the completion of main irrigation facilities (Batang Hari Weir, trunk canals and drainages, etc.)

Table 3: Effect Indicators

Indicators	(1) Performance at Appraisal (1996)	(2) Target at Appraisal (2013)	(3) Amended Target (2011)	(4) Performance (2010) (Note 1)
Rice Planted Area (ha)	(Rainy Season) 3,772 (Dry Season) 3,772	(Rainy Season) 18,733 (Dry Season) 18,733	6,682	8,278
Rice Production (ton)	(Rainy Season) 10,977 (Dry Season) 9,430	(Rainy Season) 93,330 (Dry Season) 75,695	53,957	37,523
Unit Rice Yield (ton/ha)	(Rainy Season) 2.9 (Dry Season) 2.5	(Rainy Season) 4.5 (Dry Season) 3.7	4.5~5.0	4.33
Gross Agricultural Revenue (1,000 rupiah)	(Rainy Season) 1,004 (Dry Season) 863	(Rainy Season) 1,553 (Dry Season) 1,277	-	21,871 (Note 2)

(Source) (1) (2) JICA appraisal documents, (3) JICA internal documents, (4) BPS (Kabupaten) statistics (Aggregated figure of Kecamatan which involve the project area)

(Note 1) As explained in Section 2.3 2), statistics relating to the effect indicators of the project area have been replaced by the municipality (Kabupaten)-based ones after the project completion. Figures in (4) are the referential approximations aggregating the figures of Kecamatan (sub-districts) which involve the project area, therefore not directly consistent with the previous figures in the left columns. Those are yearly figures since the seasonal (rainy and dry) data are unavailable.

(Note 2) Statistics of BPS (Kabupaten) do not take this indicator. This figure is the gross agricultural revenue per household in 2009 reported in a JICA internal document.

The JICA Mid-term Review (cf. footnote 6) points out the following factors that have caused the unsatisfactory results above: the economic factor of steep price increases in estate crops during the project implementation that lessened the incentive for rice farming; social factors such as obstacles for land development derived from unclear land ownership of communal lands, difficulty in arbitrating conflicts of interest between immigrants and natives; consequent technical and institutional factors making the secondary to tertiary canal connections difficult; and an administrative factor of newly established immature organizational management capacity. However, as will be discussed in the following Section (1), although the performance of rice production could not achieve the target mainly due to a bottleneck of fertilizer supply, the performance of other indicators exceeds the amended targets. The unit yield successfully attained the initial target at the appraisal as well.



Primary Canal
Functioning as a Regional River



Tertiary Canal
Extending to Farm Fields

(1) Impact Study conducted within Project

Coupled with the physical construction of irrigation facilities, the project extended the Agricultural Extension Services Program (AESP) which organizes ten Tertiary Development Units (TDUs) and extends assistance to them by supplying agricultural machines for group farming and stationing permanent extension workers. The project conducted a baseline survey taking samples of 120 rice farmers from nine TDUs located in Kabupaten Dharmasraya in 2003 and an ex-post study in 2008 asking same questions to the same respondents. The following study results indicate that the contribution of the irrigation system by the project is obvious for rice production.

- (a) The rate of irrigated farms increased from 25% (baseline) to almost 100% (at Ex-post study)
- (b) Insufficiency of water, the top-ranked bottleneck for agricultural production at baseline, has disappeared as a disturbing factor except minor numbers of respondents at the ex-post study.

On the other hand, the volume and area of rice production at the ex-post study have declined from the level of the baseline. Table 4, which shows the regional rice production trend in West Sumatra Province, also indicates this phenomenon. Rice production in 2009 and 2010 was less than the level of 2008 only in the project region. In terms of unit yield, as well, it is only 3.27 ton/ha, much less than the BPS statistics (cf. Table 3) and 0.58 ton/ha down from the baseline. The main reason for this reduction was the difficulty of fertilizer procurement, which is obvious from the results of the impact survey in which the respondents rated it as the overwhelming top-ranked obstacle for their rice production, while it used to be one of four main reasons at the time of the baseline survey. This is also consistent with the official opinions expressed in the

meetings with the regional governments of West Sumatra Province and Kabupaten Dharmasraya during the ex-post evaluation field survey. The Agricultural Office (Dinas Pertanian) of the regional government of Kabupaten Dharmasraya has changed the official suppliers of fertilizer based on the analysis that the problem lies in its distribution process. They optimistically stated their opinion that this decision would get rid of that tough bottleneck. It is therefore necessary to continue watching how things turn out.

Table 4: Annual Rice Production in Different Regions in West Sumatra Province

	(Unit: 1,000 ton)						
	2004	2005	2006	2007	2008	2009	2010
West Sumatra Province			1,889	1,938	1,965	2,105	2,211
Kabupaten Dharmasraya			27	45	49	51	58
Total of Kecamatan which involve Project Area	33	30	26	43	47	36	38

(Source) Made by the Evaluator based on the BPS Statistics

(2) Beneficiary Survey in Ex-post Evaluation

The Ex-post Evaluation conducted a beneficiary survey interviewing total of 131 rice farming households of four TDUs (including one in Jambi Province) discretionarily selected to avoid regional bias. As for the rice production, 85% of the respondents answered “increased” (82% answered “remarkably increased” among them) and enjoyed consequent income increase. It is not consistent with the result of the “Impact Study” discussed above, however, most of the respondents complained about the fertilizer problem as a major obstacle for rice production. With regard to the AESP, some discontent was heard from some farmers against infrequent extension services, but most of the respondents appreciated the positive effect of the provided farming machines and other physical inputs on their agricultural production.

In view of the fact that the project’s effects and impacts extended over a wide range, the questions were not limited to rice production issues but expanded to include general economic and social matters to freely hear from the farmers as the general public in the region. The project effect and impact issues analyzed in the following sections reflect those opinions and comments.

3.2.2.1 Economic Effects

1. Sapling Production of Estate Crops

Although rice production is a general priority, estate crops such as rubber and oil palms are inherently recognized as having a comparative advantage over rice with higher priority in regional development in Sumatra Island where this project is located. That advantage is also stated in the national RPJMN (2010~2014): Section for “Development with Territorial Dimen-

sion) and Regional (RPJMD Dharmasraya 2011~2015) Medium Development Plans. As the latter declares “blessed with suitable weather and soil conditions”, Dharmasraya has great potentiality in producing estate crops. The total planted area of rubber and oil palms occupy more than 70% of the national total.

In the beneficiary survey conducted in the ex-post evaluation, which directly interviewed 131 rice farmers (households), 61 and 5 farmers are planting rubber and oil palms respectively. To

Table 5: Production and Unit Price of Rice and Major Estate Crops

	Production (t)	Planted Area (ha)	Productivity (t/ha)	Price (Rp./kg)
Rice	58,043	12,956	4.5	7,000
Rubber	28,238	38,271	0.7	14,500
Oil Palms	371,413	24,310	15.3	15,200

Source: Dharmasraya Dalam Angka (Dharmasraya in Figures) 2011, BPS Dharmasraya

the question of the future possibility of quitting estate crop production and specializing in rice, all the respondents answered “definitely no possibility.”⁸

On the contrary, most of the specialized rice farmers expressed their hope to extend their farming to rubber, oil palms and other estate crops when they are able to afford it. They would like to do so, aiming to get rid of the present rice monoculture, and to be prepared for extraordinary expenditures like entrance fee for children’s enrollment to higher-grade schools, etc. with more stable earnings through diversified income sources. Income earned by raising cattle is also for the same purpose.



Seedbed of Rubber Sapling



Planted Saplings in Rubber Estate

Oil palms were scarcely planted before this project plan, but it has already grown as one of the major crops, together with rubber. Adult rubber plants dislike water, but during its sapling

⁸ Prevailing answers confess their wishes to go on to rubber or oil palms, quitting present rice production due to difficulties caused by the fertilizer problems already stated.

stage, it demands sufficient water to grow. The availability of water for that particular use from the project canals has been greatly helping the growing sapling production businesses in the region. Information regarding these activities obtained at the Kabupaten Office of Estate Crops and Forestry (Dinas Perkebunan dan Kehutanan) is as follows:

- (1) Besides the major estate crops of rubber and oil palms, cocoa is also planted. Those estate crops had been partly planted before the project, but it was not until the project that their rapid growth has been experienced.
- (2) Currently eight companies and other organizations are operating estate crop production. According to the official production reports to the kabupaten government, they have a total of 1.7 million trees planted, normally bearing two crops a year. Some of them directly draw water from small rivers in the region, but mostly they utilize water taken from the project canals.
- (3) Besides that organizational production, there are numbers of farmers individually producing estate crops, but the kabupaten government does not collect any data on their production.

According to the individual answers of the farmers, depending on the variety, they are selling for approximately 10,000 rupiah a piece on average. Excluding the transactions of the products without using the project canal water in (2) and (3) for which no official production figures are available, the annual total value of production amounts to about 34,000 million rupiah.

2. Aquaculture

Freshwater aquaculture is widely operated in the fish ponds developed in the project area. Those activities also previously existed, according to the Kabupaten Office of Livestock & Fishery (Dinas Peternakan dan Perikanan), but their rapid growth occurred after the advent of the canals by the project completion. The kabupaten government has been also actively promoting the national policy of “Minakena” and “Minapadi” programs (cf. Section 3.1.1.2).

The potentiality of the fishery in Kabupaten Dharmasraya is significantly high, which is evident from the following Table 6 that shows the overwhelmingly high growth rate of the forecasted fishery production during 2010~2014 among the 19 kabupatens and cities in West Sumatra Province with a 28-times increase during that five years.

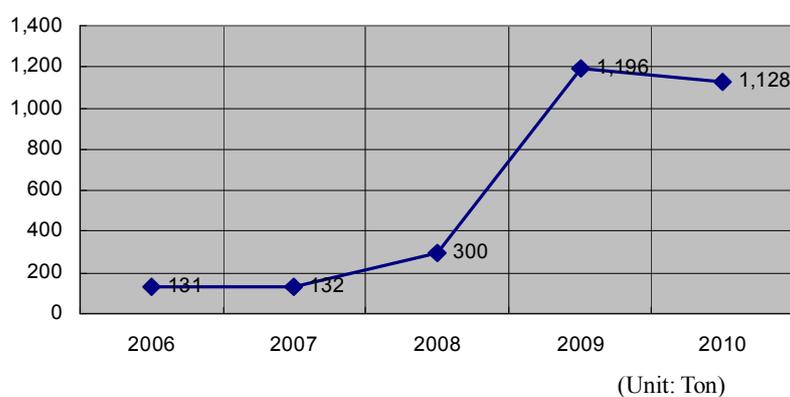
Table 6 : Production Plan of Aquaculture in West Sumatra Province

(Unit: ton)

	2009	2010	2011	2012	2013	2014	Annual Growth
Province Total	84,864	118,372	150,946	192,450	243,034	306,940	29%
Other Kabupatens & Cities	83,816	115,559	144,683	180,549	224,075	277,690	27%
Kabupaten Dharmasraya	1,048	2,813	6,263	11,901	18,959	29,250	99%
Performance of Kabupaten Dharmasraya	-	1,555	5,354				

Source: Governor's Regulation, West Sumatra Province No. IV OR 523-24-2010, data from Dinas Peternakan & Perikanan, Kabupaten Dharmasraya

Figure 1 shows the production volume of the regional fish farming during the five years before and after the project. It indicates a conspicuous increase after 2008 when the water supply became fully available by the completion of the total project canals. This also supports the above assertion of the Kabupaten Office of Livestock & Fishery.



Source: Prepared by the evaluator from the BPS statistics

(Note) Since the sources are deferent, the performance shows different figures from the ones in Table 6

Figure 1: Aquaculture Production in Kabupaten Dharmasraya

Although income statistics relating to the fish farming in the project area and Kabupaten Dharmasraya are not available, the result of the beneficiary survey to fish farmers of six southern provinces of Sumatra Island conducted in the ex-post evaluation of the JICA financed "Freshwater Aquaculture Development Project in Indonesia" (2010) indirectly supports the income effect of the Batang Hari Irrigation Project. The study has shown that the average annual

sales profit earned by fish farmers (100 households) of two kabupatens in Jambi Province (Bungo and Batang Hari) ⁹was 3,640 thousand rupiah¹⁰, which is 25% of the average income of the two kabupatens concerned in 2010 at 14,583 thousand rupiah. Even after taking account of the probable fact that their income level would be considerably higher than the average household because fish farming is usually a supplemental income source in addition to agriculture or some other main income generating activities, the weight of the fish farming income is rather high. In the light of above, it can be judged that the income effect of this project is also high.

The fish farming in Kabupaten Dharmasraya is operated by the government-owned fish farms, organized farmer groups or individual farmers.

(1) Government-Owned Fish Farms (Hatchery Centers)

Two government-owned hatchery centers (BBI: Balai Benih Ikan), one by the central and kabupaten governments each, are currently operating. According to the Kabupaten Office of Livestock & Fishery, the production in 2011 was 1.6 million fry in total. Depending on the variety and size, an 8~12-inch Nila (Nile Tilapia), which occupies the majority, is sold at 600 rupiah on average. The

performance above indicates that the estimated total production in 2011 is evaluated at 960 million rupiah. Construction of additional hatchery centers under the central government budget is under planning now to supply fry to throughout the Sumatra Island (the ultimate target is to the whole country). Land acquisition of 30ha, which was the condition for the central budget allocation, has already been completed (converted from the former candidate site for an unrealized airport construction).

A concrete production plan has not been fixed yet; however, it is expected to produce several million fry after the completion.



Government-Owned Hatchery Center
(BBI: Balai Benih Ikan)



Aquaculture by Group Farmers

⁹ The Kabupatens of Jambi Province, which include the project area, are Bungo and Tebo. Kabupaten Batang Hari is outside of the project area.

¹⁰ Ex-post evaluation report 2010 "Freshwater Aquaculture Development Project in Indonesia" (http://www2.jica.go.jp/ja/evaluation/pdf/2010_0600245_4_f.pdf)

(2) Fish Farms by Group Farmers

As have been discussed in Section 3.1.1.2, the national policy has been promoting farm-based aquaculture under the schemes of “Minakena” and “Minapadi” in the social empowerment programs supporting the poverty alleviation program in the fishery sector. Kabupaten Dharmasraya is also actively implementing policies for organizing fish farmer groups, providing technical assistance and financial support for construction and operation of fish ponds.

(3) Fish Farming Business by Individual Farmers

Individual-based fish farming is widely operated in the project area installing small-size fish cages (kerambah apung) on the project primary canals and contributing to additional cash income for farm households. However, the Kabupaten Office of Public Works, which is responsible for canal management, and the Office of Environment are carefully watching and regulating those activities because disordered expansion of this practice will damage the water flow and quality.



Installed Aquaculture Cage on Primary Canal

3.3 Impact

3.3.1 Impacts to Beneficiaries

3.3.1.1 Improvement of Living Environment of Regional People and Economic and Social Development of the Region

All the project effects other than ones for rice production, discussed in preceding Section 3.2 “Effectiveness,” are the water resource effects derived from the direct water use from the canals constructed by this project. The central as well as regional governments are of the unanimous opinion that the influence of the facts stated in Section 3.2.2.1, as the economic effect and indirect impacts identified in Section 3.3.2.1, have significantly contributed toward the regional economic growth and development. Kabupaten Dharmasraya’s Gross Regional Domestic Product (GRDP) was 2,678 billion rupiah in 2011. The rate of per capita income growth in the same year was 6.51%, and it is the highest among the 19 kabupatens and cities in West Sumatra Province, as shown in Table 7, well exceeding the Province average of 5.93%. In addition, the growth rate of Dharmasraya has been continuously above the Province average since 2005. Its performance has been stably maintaining a constant level of 6%, even at the time of the Lehman Shock in 2009 when the growth rate of West Sumatra Province drastically dropped down to 4.1%.

According to the JICA documents at appraisal, the perceived per capita income of the project

region at the E/S Loan appraisal was 157 US dollars. The current corresponding figure is not available. The approximate value of the per capita income of Kabupaten Dharmasraya in 2010 taken from the BPS statistics was 13,984 thousand rupiah. Discounting this amount with accumulated rate of inflation since the E/S loan appraisal (assuming it be a 1992 figure), the adjusted figure is 2,072 thousand rupiah. This level shows approximately a 1.5-times increase from the 1,425 thousand rupiah, which is obtained by converting the original 157 US dollars with the exchange rate at 2010.

Table 7: Income Indicators of West Sumatra Province (2010)

	Per Capita Income (rupiah)	Increase Rate of Per Capita Income
Average: All Kabupatens & Cities	17,978,726	5.93%
Kabupaten Dharmasraya	13,984,041	6.51%
Average: Other 18 Kabupatens & Cities	18,200,653	5.90%

(Source) GRDP Kabupaten Dharmasraya (Long-term Regional Development Plan <RPJMD> 2006-2010,
BPS Kabupaten Dharmasraya

As already seen in Section 3.2.1.2, the beneficiary survey in this ex-post evaluation to 131 people including non-farmers, all the respondents affirmed income increases and resultant improvement in their general living standard (84% answered “remarkably”) compared to the conditions before project. Particularly, all of them recognize improvement in children’s education (94% answered “remarkably”) and family health (82% answered “remarkably”). The result also revealed an overall increase in household income, agricultural production cost and general cost of living, which can be regarded as a reflection of the expansion and activation of the regional economy occurring in the project area. Furthermore, 98% of the respondents affirmed its relation to this project (85% answered “remarkably”). It attracts special attention that 69% of rubber and 60% of oil palm planters, who do not use water for production, also acknowledged production and income increases, mentioning remarkable improvement of transport for marketing their products by means of former inspection roads of the project that became available for normal transportation after the project as a major reason. As for the cost of production and living, 90% of the total respondents connect it to the project as well. As basic reasons for the changes, quite a few respondents pointed out multiple and complex factors including increase of cash income from rice production, promotion of estate cropping, activated economic operation through smoother transportation by means of the irrigation canals and roads constructed originally for canals inspection. It obviously indicates that the project effects and impacts are by no means

single or linear, but they have brought a compound, sometimes synergetic influence.

The project's income effect on the aquaculture has been discussed in Section 3.2.2.1 2. In addition to that, it is recognized that all of the other multiple elements explained in this evaluation report that were brought about by the project have substantially contributed to the economical development of the region.

As evidence of the remarkable income increase in the region, people pointed out the disappearance of regional public transportation services. They remarked on the phenomenon that most households in the region now possess one or more motorcycles (more than a few residents even own an automobile) as the factor to make minibuses economically unprofitable due to insufficient passengers to carry. There are other indications that represent the advancement of the regions' economy. A typical example is the plan to construct an airport, although it was eventually unrealized (cf. Section .3.2.2.1 2, about fish hatchery center to be constructed at this site). In 2006~2007, institutes of higher education (STIKES, STMIK, STKIP) having departments of science of nursing, computer and education were established. A television station is opening in 2012, and a large-scale hospital is now under construction, too.

Kabupaten Dharmasraya is a municipality newly established on January 7, 2004, detaching the area of the Batang Hari Irrigation System and adjacent part from Sawahlunto and Sijunjung Kabupatens. It was born as a result of the regional development of the Batang Hari Irrigation Area. In other words, according to the statements of central, provincial and kabupaten governments, if there had not been the Batang Hari Irrigation Project in the region, the Kabupaten would not exist. If that is the case, this project also exerted its influence on the municipal administration in addition to the economic and social aspects.



STIKES Collage Campus



Regional Hospital under Construction

3.3.2 Other Positive and Negative Impacts

3.3.2.1 Secondary Impact Derived from this Project

1. Regional Transportation

The north part of the project region is located along the Trans-Sumatra Highway, but internal transportation under poorly developed regional road systems was considerably limited. Local transportation of products used to be made mainly with manually-handled trolleys on foot. After the project, however, in addition to the trunk canals that became utilized as water transport, the canal inspection and connecting roads constructed under the project also started to be used for general uses as integral transportation media. All of them are thus contributing to the regional economic and social vitalization as transportation routes for work and life.

Although no statistics are available on the traffic volume, it was found from the explanation of the Kabupaten Office of Transportation, Communication, Information Tourism and Culture and listening to the people that the former inspection roads have enabled speedy transportation of various products in bulk. Especially the greatest beneficiaries are the estate crop planters



Former Inspection Road
Regional Major Transport Media after Project

for their marketing transport by means of the former inspection roads constructed under the project¹¹. Synergy with private vehicles, reflect-

ing the regional income growth, is also recognized. Furthermore, distant locations are now approachable and then may be used as fields for estate cropping.

2. Advent of New Water-using Businesses

A typical example is the advent of car washing businesses using the canal water. The level of their service charges is 35,000 rupiah for a car and 10,000 rupiah for a motorcycle, which is profitable enough with generally higher charges than prices prevailing in the capital city, Jakarta.

3. Mini-hydro Power Generation

A pre-feasibility study has been conducted for construction of a mini-hydro power plant at the location of a former pumping station which has been discontinued from the 1990s (JICA: Survey for Maximum Utilization of Irrigation Water in the Republic of Indonesia).

¹¹ The selling price of crude rubber, which is sold by weight, drops with the lapse of time because of weight reduction. Oil palms rapidly go bad if the oil expressing is not finished within 24 hours. Therefore those products require speedy transport to the markets.

A mini-hydro generator has been installed and working for the electric supply in the recreation site “Danau Cinta” shown in Section 7 (1) below.

4. Increase of Ground Water

As already introduced in Section 3.2.2, the widespread local opinion heard during the field survey expressed that this project has brought almost the same effect as the creation of a new never-drying river in the region and turned the underdeveloped arid land into wet, arable soil.

The Kabupaten Office of Livestock & Fishery stated that the soil turned green and cattle grazing has been facilitated with rich pastures. Almost all the 131 respondents of the beneficiary survey are raising cattle, goats and/or other livestock for investment to prepare for children’s entrance to the schools of higher grade, local ceremonial events and other extraordinary expenditures. Most of the



Secondary Canal
Arid Soil Turned Watery

respondents mentioned that it was not until the project completion when the dry season ceased

to kill the pasture. Water supply systems for domestic use have not been developed at the moment in the project region (see the following Section 5). The people revealed that it used be necessary to bore a deep well to reach the water vein but it often dried up in dry seasons. However, it scarcely happens throughout the year nowadays. It was also disclosed during the joint meeting with the relating governmental agencies at the Regional Planning Agency (BAPPEDA) Kabupaten Dharmasraya that it used to be necessary to drill 10m-deep well to draw ground water, but now, only 4m sinking is enough.

5. Domestic Water

Kabupaten Dharmasraya has had no water supply system yet for domestic use, mainly depending on ground water now (see Section 4 above). To end this situation, three water processing plants are under preparation, two of which have already entered the stage of tendering of candidate contractors. After the construction has been completed and operations have begun, the facilities will be able to supply domestic water throughout the kabupaten.

6. Disaster Protection

According to the Regional Disaster Management Agency (BPBD), this project has contributed a lot to regional disaster prevention. It brings about not only the social but also economic benefit alleviating natural damages on economic activities.

(1) Flood Control

The lowland areas along the Batang Hari River used to be subjected to occasional floods in

the rainy seasons every year in January and February. However, floods are now being prevented by the water flow control with the Batang Hari Weir constructed under the project.

(2) Fire Fighting

Regional fire fighting activities became more effective and efficient by easier access to water intake from the canals running throughout the project area.

7. Provision of Recreational Opportunity for Regional People

There used to be almost no recreational facilities for people before. This project has indirectly provided regional people with the following entertainment facilities and contributed to increasing the people's welfare.

- (1) An entertainment facility named "Danau Cinta (Lake of Love)" was developed with private sector participation. It has a play pond and swimming pool for children which collect several hundred visitors every weekend. During the Islamic New Year in 2011, more than a thousand people in total visited this facility.
- (2) A citizens' boat racing festival is held by the kabupaten government on the project main canals.
- (3) The Batang Hari Weir itself became a tourist spot, also providing a place suitable for entertainment fishing.



Danau Cinta : Swimming Pool for Children



Danau Cinta : Boating Pond

3.3.2.2 Impact on Natural and Social Environment

(1) Impact on Natural Environment

Impact of project implementation on natural environment was examined monitoring water quality and fish habitat at the Batang Hari Weir, and periodical environmental checks were also conducted during the construction stage. Those assessment results were reported to BAPPEDA of West Sumatra Province with no specific negative impact on natural environment.

The Office of Environment of Kabupaten Dharmasraya reported no specific negative impact as well, or rather, they declared a positive environmental impact with the ecological improvement overall from the previous arid soil to watery conditions¹².

(2) Impact on Social Environment (Including relocation and land acquisition)

Land acquisition as large as 730ha for the project implementation was completed in 2006 with the allocated budget by the Directorate General of Water Resources, Ministry of Public Works under the relevant Indonesian laws and regulations without any specific problems. Relocations did not occur as planned.

To summarize the points discussed above, the original purpose of the project at the time of planning had been to contribute to agricultural production mainly focusing on rice, but it changed its course to diversify the water use for various economic and social activities. The Indonesian government reviewed and then adjusted the targeted irrigation area, which is one of the rice related indicators, to fit the reality in the course of project implementation. This change in project purpose could be hardly anticipated at the appraisal of the phase II stage; however the amended targets in relation to the rice production have been mostly achieved at the time of ex-post evaluation. In addition to this fact, the development of aquaculture, estate crop production and other multiple project effects have been successfully contributing, as discussed in this Section, to the higher objectives which are the people's income increases as well as the activation of the regional economy. Those positive facts are also supported by the results of the beneficiary survey and discussions with responsible officials of the governments.

As a conclusion, therefore, this project has largely produced the expected effects and impact, and its effectiveness is high.

3.4 Efficiency (Rating: ②)

3.4.1 Output

The project is to implement construction of Batang Hari Weir, development of irrigation and drainage canals, farmland development and consulting services at the upstream area of Batang Hari River in West Sumatra Province. It was implemented under three ODA loans being initiated by the engineering service loan (E/S loan), preceding to the phase I and II loans for physical implementation.

¹² However it by no means signifies that there is no environmental problem prevailing in the region. Batang Hari River has long been known as a placer mining spot, and has been annoyed by illegal mining in spite of the control of the environmental authorities. It threatens the water quality of Batanghari River and its irrigation system, and consequently, it may adversely affect the project effects and impacts. Although this has not yet occurred, the Kabupaten Office of Environment mentioned it as a matter of careful watch on a constant basis. That control is actually a continuous headache for the Office of Environment together with the illegal logging at the watershed of Batang Hari River.

According to the plan, the E/S Loan stage was to carry out additional studies to supplement existent studies, topographic and geological surveys, preparation of the implementing schedule and then to provide detailed designing. The following physical project implementation has proceeded based on the study results of the engineering services under the E/S loan, however the volume of man-month input, actual project cost incurred and its other details are unknown due to the lack of relating project implementation record. The phase I stage implemented civil works: rehabilitation of existing main office and its related structures; construction of inspection roads and their connections to the local public roads; construction of Batang Hari Weir; construction of primary and secondary canals; and drainages downstream and in the area of the Siat Weir. The phase II works included continued civil works for construction of remaining primary, secondary and tertiary canals and drainages, farmland development, procurement of operation and maintenance (O&M) equipment and implementation of Agricultural Extension Services Program (AESP). Table 8 comparatively shows the planned outputs and their actual performance.

Table 8: Comparison between Planned Outputs and Performance

Planned Output	Actual Output
(1) Civil Works Construction of Batang Hari Weir: One unit Construction of Access Roads: 12.1km Rehabilitation of Project Office & Related Structures: One set Headrace Channel: 15.5km Primary Canals: 76.1km Secondary Canals: 257.0km Drainages: 187.1km	(1) Civil Works Construction of Batang Hari Weir: One unit Construction of Access Roads: 12.1km Rehabilitation of Project Office & Related Structures: One set Headrace Channel: 15.5km Primary Canals: 76.9km Secondary Canals: 286.2km Drainages: 186.9km
(2) Procurement of O&M Equipment Dump Trucks, Bulldozers, Portable Pumps, etc.	(2) Procurement of O&M Equipment Dump Trucks, Bulldozers, Portable Pumps, Trailers, etc.
(3) Tertiary Canals & Farmland Development Tertiary Blocks: 465 units Farmland development: 12,543ha	(3) Tertiary Canals & Farmland Development Tertiary Blocks: 197 units Farmland development: 3,600ha
(4) AESP	(4) AESP
(5) Consulting Services E/S (International: 102MM Domestic: 233MM)	(5) Consulting Services E/S (Unknown)
(I) International: 261MM Domestic :314MM	(I) International: 265MM Domestic :610MM
(II) International: 242MM Domestic: 605MM	(II) International: 247MM Domestic: 1,028MM

Source: JICA Internal Documents, Consultant's Records

Except for the differences between the plan and actual performance in the areas of tertiary canal construction, farmland development and consulting services due to the following reasons, the actual outputs are almost the same as planned.

1. Tertiary Canals and Farmland Development

The Mid-term Review Report and JICA internal documents analyze the main reasons of the significant decrease of the actual outputs against the plan.

(1) Economic Reason

Prolonged time for waiting to start rice production, due to several reasons including malfunction of the World Bank funded irrigation facilities, obliged farmers to plant rubber and other estate commodity crops instead of rice for subsistence. In addition to the background of the region's suitable environment for estate crops, price hikes further worked on the farmers giving disincentives to go back to the original rice farming. These factors strongly affected the situation to drastically reduce the demand for rice farming from the initial plan.

(Drastic Reduction in Rice Farming Area vis-à-vis Original Plan)

The area actually irrigated in 2011 is 6,682ha (35%), against the total farmable area by irrigation of 18,936ha (from JICA internal documents). The difference consists of (a) estates of commodity crops (7,200ha), (b) non-paddy farms (1,400ha), (c) swamp (2,500ha) and (d) forests and grasslands (1,800ha). (Figures obtained at the Mid-term Review are shown in the brackets for reference)

(Drastic Reduction in Farmland Development Area vis-à-vis Original Plan)

The area actually developed is 3,600ha (26%), against the plan of 13,750ha, among which totally 800ha has not been used at the project completion. The main reasons are that (a) it has been converted to other crops, (b) the expected land use has been prevented due to unclear land ownership, (c) farmers are discouraged from rice farming due to heavy workload of cultivation, etc.

(2) Social Reason

The project has also been subject to social obstacles such as (a) difficulties for farmland development due to unclear land ownership, (b) conflict of interests with the native inhabitants, etc.

(3) Technical and Institutional Reason

Scattered land development areas caused by above reasons made the connection between secondary and tertiary canals difficult.

(4) Administrative Reason

To solve problems relative to land ownership effective official arbitration by the government is needed. However, Kabupaten Dharmasraya which was newly born in 2004 was not yet

matured enough to effectively carry out that responsibility in practice.

2. Consulting Services

As shown in Table 8, man-month volume of domestic consultants was well over the plan. It was the result of the increased tasks from the significant design change due to the following factors.

- (1) Frequent route changes of tertiary canals due to the reasons stated in 1 above.
- (2) Changes in acquired lands.
- (3) Requests from tertiary canal site landowners to change the original design to concrete lining to prevent landslides.

Additionally, increases of AESP activities also worked as a factor to increase domestic consulting works.

3.4.2. Input

3.4.2.1 Project Cost

The amount of total project cost is unknown because of the lack of all the information regarding the E/S loan. The total project cost of the main portion excluding the E/S is as follows.

Planned project cost of the main portion was 23,352 million yen (the total cost including E/S loan portion was 24,148 million yen), and the corresponding actual cost incurred is 12,982 million yen, 56% of the planned. The main reasons by which the plan was completed under budget, in spite of delays in the project implementation, are as follows.

- (1) Considerable reduction in the scope of tertiary canals and farmland development.
- (2) The drastic depreciation of rupiah currency, up to a quarter of the previous level due to the Asian currency crisis, occurred in 1998 before starting the phase II stage and wrought a significant negative influence on project costs of the E/S loan and the stage I portion of the project.
- (3) The actual cost obtained does not include the contingency and taxes which were estimated in the plan

3.4.2.2 Project Period

Under the initial plan, the total project period was from November 1993 to December 2006 (158 months), but the actual project period was from November 1993 to March 2009 (185 months), which turned out 117% of the original plan, slightly longer than planned.

Stage I was completed mostly as scheduled, in spite of some additional works, however, stage II was delayed due to the reasons below. The considerable outputs decrease in the tertiary canals and farmland development has brought no significant period reduction because the efforts were fully attempted to attain the planned outputs.

- (1) The tender evaluation result of the International Competitive Bidding (ICB) package during the contractor selection was approved by the tender committee but failed to obtain the final authorization of the Minister of Public Works. This imposed re-tendering based on the authorized Pre-qualification (PQ) result and prolonged the construction commencement for two years.
- (2) Hikes in construction cost mainly due to the rise in oil prices occurred twice during the stage I implementation and obliged cost re-allocation from the second stage. It took about a year to clear the required administrative procedures for that.

3.4.3 Internal Rate of Return (IRR) (for reference)

As this project does not aim for revenue earning operation, the Financial Internal Rate of Return (FIRR) has not been applied since the project appraisal.

Based on the original project purpose of irrigation for paddies, the Economic Internal Rate of Return (EIRR) was calculated using agricultural production increases, mainly focusing on rice as the project benefit at appraisal. As already discussed in the previous sections, this project has grown out of the original scheme with paddy irrigation mostly as the sole purpose, and became a comprehensive water resource system to meet the region's various water demands effectively. There is no data to precisely quantify all the identified project effects and express them in monetary terms. In addition to that, the total project cost is unknown due to the lack of cost information for the E/S loan. This situation prevents estimating the EIRR meaningfully. However, EIRR calculation only based on the benefit of rice production increase with the same method as the appraisal is attempted in JICA internal documents. The result is presented below for reference.

The EIRR has reduced below less than a half from the appraisal figure. The main reason would be the significant reduction in scope of the tertiary and farmland development and resultant remarkable decrease in expected rice and other agricultural production growth.

Table 9: Conditions and Results of EIRR Calculations

	Appraisal	JICA Internal Documents
Project Life	50 years after operation commencement	
Cost	1. Construction Cost (Total Project) 2. O&M Cost (1,354million rupiah annually) 3. Facility Replacement Cost	
Benefit	Net income increase derived from increases of rice and other food crops production	
EIRR	(I) 12.42% (II) 12.6% (Project life: 45 years. Other conditions remain unchanged.)	5.47%

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

Since the Batang Hari Irrigation area extends across two provinces, West Sumatra and Jambi, the operation and maintenance of the weir and trunk canals falls under the jurisdiction of the Directorate General of Water Resources, Ministry of Public Works following the Government Regulation for Irrigation, and is practically managed by the Sumatra VI River Basin Organization (Balai Wilayah Sungai Sumatera VI) continuously from the implementation phase. However, in reality, because of the system's importance stressed below, the kabupaten government discretionarily takes part in the operation, maintenance and restoration activities if need be¹³.



Canal Maintenance Work by Farmers

As for the AESP portion, the function of the BH-AD: Batang Hari Agricultural Development Office which was responsible for carrying out the services has been succeeded to the Office of Agriculture (Dinas Pertanian) of Kabupaten Dharmasraya after the project completion, and continuing extension services and monitoring with agricultural indicators are conducted (the scope is not the project area but on a municipal basis by kecamatan <sub-district>). The equipment procured under the project is in good condition.

On the other hand, operation and maintenance of end irrigation canals is under the responsibility of Water Users Associations (WUAs). However for the Batang Hari Irrigation System, their functional organization remains immature and inactive. Therefore, systematic operation and maintenance of end canals has not been satisfactorily performed.

The facilities constructed under the project have grown beyond a mere irrigation system for rice irrigation and have been supplying water to various uses that exceed the scale of compact and limited water management by WUAs. The Batang Hari Irrigation System is now working as the lifeline of the Kabupaten Dharmasraya. That reality provides a strong incentive for operation and maintenance to the Ministry of Public Works, which is responsible for the whole system excluding end canals of the farm fields as well as to the Kabupaten Dharmasraya as a project beneficiary. This “demand-pull” factor induces consolidation of the structural aspect for imple-

¹³ Typical cases include the collapse of a primary canal on September 18, 2011, and water leakage from a canal on January 30, 2012. To cope with these problems, the Balai Wilayah Sungai Sumatera VI carried out emergency restoration works in strong collaboration with the kabupaten government. This news made the headlines of the local newspapers.

menting operation and maintenance from the “supply side.” On this background, a system for functional cooperation is solidly working, being led by the Balai Wilayah Sungai Sumatera VI with official leading responsibility, and its weaknesses are supplemented by the kabupaten government. Conversely, the conditions that are supported by this “demand-pull” factor may have been hampering functional organization and development of WUAs. As the well-organized operation of WUAs is essential for proper operation and maintenance of the paddy irrigation portion of the whole system, the Office of Agriculture of the kabupaten government should make further efforts to lead and support their improvement as the institution in charge.

As detailed in the sections for effectiveness and impact, the irrigation system developed under this project is functioning as comprehensive water resource facilities to meet a wide range of water demand beyond the original purpose for rice production, and it is also contributing to regional economic development as indicated in the impact section. Irrigation facilities in Indonesia are governed under the Government Regulation for Irrigation (“Peraturan Pemerintah tentang Irigasi”). The facilities developed by this project are literally an irrigation system and managed by the Ministry of Public Works. However the substance has already expanded beyond a scope to be managed by sticking to the agricultural rules, taking mainly account of rice production which supposes small scale water utilization. The central as well as local governments actually connive at its discretionary use and exercise no prohibition on account of official regulations for almost any use of the project water. That behavior has been actually deriving the maximum effect from the facility operation; however it establishes a situation where facility use deviates from official regulations and tends to allow disordered water and facility use. By reviewing the water balance of the canals and river flows, plans for agricultural extension, water utilization plans of each diversified water use, and so forth, the government should develop consistent and appropriate rules for facility operation and management aiming to maximize effective water use on a regular basis.

3.5.2 Technical Aspects of Operation and Management

Technical teams are organized in Balai Wilayah Sungai Sumatera VI for operation and maintenance of weirs and trunk canals. The weirs are operated and maintained by six assigned technicians. Trunk canals are separated into two management areas and severally managed by approximately fifteen conventional water masters called “juru.” They have been working for a long time, since the days of the old systems, by weirs installed at two small tributaries before the project, and are technically capable enough. However, they are basically part-timers, and no permanent staff are assigned due to budget shortages which prevents satisfactory operation and maintenance of the system. Operation and maintenance manuals for weirs and canals were prepared within the project and effectively used as guidelines for field works.

3.5.3 Financial Aspects of Operation and Maintenance

An operation and maintenance budget of 150,000 rupiah per hectare is allocated according to the area of irrigated farm fields. For the Batang Hari system, budget allocation is made based substantially on the actually irrigated area (6,779ha) to be used for entire coverage (18,936ha), which is not satisfactory. Balai Wilayah Sungai Sumatera VI gives priority on the operation and maintenance activities of the Batang Hari system, giving preferential budget allocation and sometimes utilizing budget for other purposes by postponing non-urgent programs in order to avoid malfunctions of the system.

In case the system faces a shortage in operation and maintenance budget, it is voluntarily supplemented by the kabupaten budget in order not to leave the system unrepaired due to fund shortages. However, it is necessary for the Ministry of Public Works to allocate the operation and management budget on a more rational basis to fit the field reality enabling smoother implementation, not sacrificing other public programs or putting budgetary burdens on the kabupaten.

3.5.4 Current Status of Operation and Maintenance

According to the result of technical audit by the Ministry of Public Works conducted after the project, the facilities are basically in a good condition (cf. the table below), and the water flow is also kept as designed.

Table 10: Technical Audit Opinion by Ministry of Public Works

Facilities	Conditions
Batang Hari Weir	Condition is fair with little sedimentation. The water volume is kept as initially designed.
Primary Canals	50.5km out of the 95.1km in total have no problem. Although a portion of 45.6km has slight trouble, overall conditions are found satisfactory.
Secondary Canals	Slight trouble in 15km, and medium trouble in 15km out of the total 203.4km is found, but the total conditions are fair.

Source: Lampiran Pendukung “Audit Teknis Infrastruktur Sumber Daya Air – Daerah Irigasi Batang Hari (Technical Audit Report of Water Resources Infrastructure: Batang Hari Irrigation Region <D.G. Water Resources, Ministry of Public Works>

A visual check was also performed in the field beneficiary survey. Although some parts of the end canals are not maintained well and fail to supply enough water to the paddy fields, the maintenance conditions of Batang Hari Weir and trunk canals are fair.

Effective function of facility operation and maintenance to support project sustainability primarily depends on the supply side factors consisting of the structural, technical and financial aspects. From the other side, in the case that the beneficiary and the operation and maintenance

body are identical or duplicate, the demand-pull inducement reflecting the strength of the facility needs and operational effect strongly works on good maintenance practice. The officially responsible agency for operation and maintenance of this project is Balai Wilayah Sungai Sumatera VI, but a framework has been formed in which the weaknesses are supplemented by the kabupaten government, who is the direct beneficiary of the project facilities, and a collaborative operation and maintenance is practiced. Although there are prevalent challenges in organizing and strengthening the immature WUAs in the field of paddy irrigation and in rationalizing the operation and maintenance budget, they could hardly be identified as problems to seriously impede the total sustainability of the project effect. Basically, the possibility that a serious problem will occur in the operation of maintenance of the facilities as a comprehensive water resource supply system is regarded low.

As a conclusion, though some problems have been observed in terms of structural and financial aspects of operation and maintenance, sustainability of the project effect is fair.

4. Conclusion, Recommendations and Lessons Learned

4.1 Conclusion

This project was to increase agricultural production and productivity by constructing irrigation and related facilities, conducting farmland development and agricultural extension services in West Sumatra and Jambi Provinces, and thereby contribute to the maintenance of self-sufficiency in food, increasing farmers' income, and improvement of their living standards.

The project is consistent with the national development and agricultural sector development plans of Indonesia that attach importance to agricultural development as a base for economic development coupled with the food security. It is also consistent with the total national development policy and meets the nation's development needs. It was not relevant, however, to have placed so much emphasis on rice. Therefore the relevancy of the project is moderate. Although the efficiency is moderate due to the delay in project implementation, the effectiveness is high, meeting regional water demand by creating comprehensive water resources for agriculture and all other prevailing uses and contributing to the peoples' income increase and the consequent improvement of the living standard within the region. The sustainability is fair because of some extent of current problems in the financial aspect and maintenance of the end canals. In light of the above, this project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to Implementing Agencies

- (1) Being represented by the lack of the project cost record of the E/S loan phase of the

project, the record keeping on the project implementation is weak. It is recommended to establish and operate a solid project management system including project accounting in implementing future projects.

(2) The operation and management budget of this project is allocated corresponding to the actually irrigated area in substance while the facilities developed are functioning as comprehensive regional water resources and providing quite a wide scope of water supply, well exceeding the irrigation area of rice and other kinds of agricultural crops. In order to maintain the total function of the facilities, a more rational concept and method of budget allocation are to be discussed.

(3) In Kabupaten Dharmasraya, the supply of farm inputs, especially fertilizer, with an appropriate price, was bottlenecked, and it has been one of the main causes of productivity and production decreases in recent years. It is required for the Offices of Agriculture of the provincial and kabupaten governments to look deeply into the causes for improving this unfavorable situation.

(4) Organization and development of water users associations (WUAs) to perform operation and maintenance of end canals is weak and it causes unfair water distribution and delayed end canals maintenance. The Kabupaten Office of Agriculture (Dinas Pertanian), which is in charge of organization and strengthening of WUAs, should focus on intensified effort and guidance to improve the present situation.

(5) The facilities developed under this project have been primarily carrying out a wide function as multiple or comprehensive water resources in the project area. Related government agencies, the Ministry of Public Works, the Ministry of Agriculture and Kabupaten Dharmasraya, should further develop effective water use with a broad perspective. Since the administration lags behind actual practices, the central and kabupaten governments should establish comprehensive water resources management with proper sharing of responsibility and promote rational and sustainable utilization of the resources.

4.2.2 Recommendation to JICA

(1) Management of project implementation and evaluation is performed on a well-established project management system. Clear agreement on the concrete procedures with the recipient government has to be reached based on satisfactory discussions at the appraisal. Especially, it is often the case in Indonesia that project accounting records are poorly kept due to a weak project management system. Paying due attention to the prevailing practice, concrete book-keeping structures and procedures to record incurred project cost are to be determined and obtain consensus with the government side.

(2) This project came to exercise wide influence over the regional economy and society well

exceeding the function only for rice irrigation. It is recommended to separately carry out an impact study to completely grasp the comprehensive effects and impacts influenced by the project facilities aiming for proper formulation and operation of future irrigation and other types of water resource development projects. The study should primarily focus on the impact items identified in this ex-post evaluation with a parallel attempt to extract other impact items. The impact items are then classified into quantifiable and unquantifiable groups; monitoring indicators are to be applied to the former and monitored using time series BPS or other statistics if available; for the latter, or items for which suitable statistics are unavailable, statistically meaningful beneficiary survey will play a central role.

4.3 Lessons Learned

(1) Although the project was originally planned with rice irrigation as its central purpose, due to the subsequent changes in surrounding conditions, the facilities came to function as comprehensive water resources to meet various water uses. Downward adjustments of the original targets and consideration and promotion of water uses other than rice farming were performed at the stage when the rice production purpose was of decreasing importance, however, a revised monitoring system for identifying new purposes has not been developed, and satisfactory discussions between JICA and the Indonesian government have not been held either on the issues relating to the change in the project's purpose. In future supervision of similar projects, there should be satisfactory discussion and establishment of revised indicators and their monitoring system if changes are needed in the project purpose during implementation.

(2) Water resources development projects including irrigation, especially ones which can enjoy abundant water volume for rice production and other targeted uses, inherently have wide range of potential impacts. Therefore, the project should be formulated with a broad perspective encompassing potentiality for other kinds of secondary use, identification of expected additional benefits, and determination of suitable indicators to monitor the identified effects, impacts, and so forth.

Comparison of the Original and Actual Scope of the Project

Item	Original Scope	Actual Performance												
1. Output	<p>(1) Civil Works Construction of Batang Hari Weir: One unit Construction of Access Roads: 12.1km Rehabilitation of Project Office & Related Structures: One set Headrace Channel: 15.5km Primary Canals: 76.1km Secondary Canals: 257.0km Drainages: 187.1km</p> <p>(2) Procurement of O&M Equipment Dump Trucks, Bulldozers, Portable Pumps, etc.</p> <p>(3) Tertiary Canals & Farmland Development Tertiary Blocks: 465 units Farmland development: 12,543ha</p> <p>(4) AESP</p> <p>(5) Consulting Services E/S (International: 102MM Domestic: 233MM) (I) International: 261MM Domestic :314MM (II) International: 242MM Domestic: 605MM</p>	<p>(1) Civil Works Construction of Batang Hari Weir: One unit Construction of Access Roads: 12.1km Rehabilitation of Project Office & Related Structures: One set Headrace Channel: 15.5km Primary Canals: 76.9km Secondary Canals: 286.2km Drainages: 186.9km</p> <p>(2) Procurement of O&M Equipment Dump Trucks, Bulldozers, Portable Pumps, Trailers, etc.</p> <p>(3) Tertiary Canals & Farmland Development Tertiary Blocks: 197 units Farmland development: 3,600ha</p> <p>(4) AESP</p> <p>(5) Consulting Services E/S (Unknown) (I) International: 265MM Domestic :610MM (II) International: 247MM Domestic: 1,028MM</p>												
2. Period	(Total) November 1993 ~ December (158 months)	(Total) November 1993 ~ March 2009 (185 months)												
3. Project Cost	(Unit: (million yen)	(I) (II) Total <E/S loan cost and composition of FC, LC are unknown>												
Foreign Currency (FC)	<table border="1"> <thead> <tr> <th></th> <th>FC</th> <th>LC</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>E/S</td> <td>431</td> <td>365</td> <td>796</td> </tr> </tbody> </table>		FC	LC	Total	E/S	431	365	796	<p>12,982 million yen</p> <p>ODA Loan Portion: 12,375 million yen</p> <p>Only converted amount into yen is available. The amounts of expenditures in local currency and therefore exchange rates are unknown.</p>				
	FC	LC	Total											
E/S	431	365	796											
Local Currency (LC)	<table border="1"> <tbody> <tr> <td>(I)</td> <td>7,191</td> <td>7,173</td> <td>14,364</td> </tr> <tr> <td>(II)</td> <td>1,480</td> <td>7,508</td> <td>8,988</td> </tr> <tr> <td>Total</td> <td>9,102</td> <td>15,046</td> <td>24,148</td> </tr> </tbody> </table>	(I)	7,191	7,173	14,364	(II)	1,480	7,508	8,988		Total	9,102	15,046	24,148
(I)	7,191	7,173	14,364											
(II)	1,480	7,508	8,988											
Total	9,102	15,046	24,148											
Total: Japanese ODA Loan Portion	ODA Loan Portion: 14,365 million yen													
Exchange Rate	<p>(E/S) 1US\$=121yen =2,060 rupiah</p> <p>(I) 1 US\$=105.7yen =2,298 rupiah</p> <p>(II) 1US\$ =109.21 yen =8,401 rupiah</p>													