Ex-Post Monitoring Report of Japanese ODA Loan Projects 2008 (Bangladesh, India)

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Ex-Post Monitoring Report of

Japanese ODA Loan Projects 2008

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Preface

Ex-post evaluation of ODA projects has been in place since 1975 and since then the coverage of evaluation has expanded. Japan's ODA charter revised in 2003 shows Japan's commitment to ODA evaluation, clearly stating under the section "Enhancement of Evaluation" that in order to measure, analyze and objectively evaluate the outcome of ODA, external evaluations conducted by experts shall be enhanced.

This volume shows the results of the ex-post monitoring for 3 Japanese ODA loan projects that were mainly completed seven years ago and were given ex-post evaluation five years ago. The ex-post monitoring was entrusted to external evaluators to review the projects' effectiveness, impact, and sustainability, to follow up the recommendations made in the ex-post evaluation, and to make further recommendations for future sustainability.

The lessons and recommendations drawn from these monitoring will be shared with JICA's stakeholders in order to apply to the planning and implementation of similar projects in the future.

Lastly, deep appreciation is given to those who have cooperated and supported the creation of this volume of evaluations.

February 2010
Atsuo KURODA
Vice President
Japan International Cooperation Agency (JICA)

Disclaimer

This volume of evaluations shows the result of objective ex-post evaluations made by external evaluators. The views and recommendations herein do not necessarily reflect the official views and opinions of JICA.

Bangladesh

Ex-post Monitoring of Completed ODA Loan Project
"Energy Saving, Environmental Protection and Improvement of On-stream Factor of Ghorasal Urea Fertilizer Factory"

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Field Survey: Sep-Oct 2009

1. Project Description

Map of the Project Area


Ghorasal Urea Fertilizer Factory

1.1 Project Objective

The objectives of the project were to improve the energy efficiency and prevent ammonia leakage of Ghorasal Urea Fertilizer Factory located in the suburb of Dhaka, by upgrading obsolete equipment that had not been upgraded before; thereby contributing to the stable supply of the urea fertilizer and improvement of environment.

1.2 Outline of Loan Agreement

Loan Amount / Loan Disbursed Amount	5,443 million yen/ 5,443 million yen
Loan Agreement / Final Disbursement Date	July, 1999 / November, 2001
Ex-post Evaluation	FY2003
Executing Agency	Bangladesh Chemical Industries Corporation (BCIC) (The Ghorasal Urea Fertilizer Factory is in charge of the management and maintenance works of the project facilities.
Main Contractor (Over 1 billion yen)	Toyo Engineering Corporation

Main Consultant (Over 100 million yen)	N/A

1.3 Background of Ex-Post Monitoring

At the time of ex-post evaluation (implemented in FY2003), there were problems related to the development of facilities which were not covered by the project (problems with the production process). As a result, the overall capacity utilization ratio of the Ghorasal Urea Fertilizer Factory had not increased. The actual urea fertilizer production was slightly lower than initially planned (approximately 80% of the planned level), giving slight concerns about the effectiveness of the project. Furthermore, concerning management and maintenance, the fertilizer factory was employing an inadequate maintenance plan and stopgap approach to handling problems with equipment and machinery. Financially, the retail price of urea fertilizer was being kept at a low, government-controlled price that did not reflect the production cost of the fertilizer, causing the project to be in debt, and raising concerns about the financial sustainability of the project. Plant facilities and equipment were becoming increasingly obsolete and it was thought that a thorough maintenance and inspection system was needed. Furthermore, it was recommended that a cost analysis of fertilizer production and a revision of the retail price system were necessary.

Given the above stated issues, this project was selected for ex-post monitoring, with the objective of confirming the operational performance, future outlook and financial improvement of plant facilities and equipment in the time following ex-post evaluation. The project was reviewed based on each evaluation item through a new field survey, with the goal of developing conclusions.

2. Monitoring Results

2.1 Effectiveness (Impact)

2.1.1 Quantitative Effects

(1) Improvement of Energy Efficiency

As shown in Table 1 below, power generation per 1 Nm^3 of natural gas has been in line with initially planned levels (2.39kWh/Nm^3 of natural gas) since the time of ex-post evaluation. Furthermore, the thermal efficiency of generators has also been improving. This may be due to the stable power supply provided by the project continuing to produce effects even after ex-post evaluation[1]. On the other hand, both natural gas consumption

[1] However, as of October 2009 the 18MW gas turbine power generator installed by the project was undergoing repairs due to a mechanical breakdown. Currently the Ghorasal Urea Fertilizer Factory is operating its plants using power supplied by the nearby Polash Urea Fertilizer Factory (just like the Ghorasal Urea Fertilizer Factory, it is a urea fertilizer factory under the umbrella of the Bangladesh Chemical

(Nm^3) and cooling water consumption per 1 ton of urea produced are a little higher than they were at the time of ex-post evaluation. According to the Ghorasal Urea Fertilizer Factory, this is because the number of shutdowns has increased since the time of ex-post evaluation, and large amounts of natural gas and cooling water are necessary when restarting plants and for restoration work. The main reason for the increase in the number of shutdowns, as was pointed out in the Ex-Post Evaluation Report, is that approximately 40 years have passed since the fertilizer factory commenced operations, meaning that all of the equipment and machinery in the factory is becoming obsolete. Then, it has resulted in the occurrence of an increasing number of malfunctions.

Table 1: Actual Value of Improvement of Energy Efficiency

At time of Ex-post Evaluation					
Item		1999/00	2000/01	2001/02	2002/03
1. Power Generation (kWh/1 N m^3 of Natural Gas)	Plan	-	-	2.39	2.39
	Actual	1.73	1.73	2.67 (111.7%)	2.62 (109.6%)
2. Thermal Efficiency at the Generating End (%)	Plan	(not specified)			
	Actual	17.0	17.0	26.1	25.7
3. Natural Gas Consumption per 1 ton of Urea Produced (N m^3)	Plan	-	-	868	868
	Actual	1,083	1,108	1,116 (77.8%)	1,041 (83.4%)
4. Cooling Water Consumption per 1 ton of Urea Produced (ton)	Plan	-	-	9.70	9.70
	Actual	13.40	13.94	14.40 (67.4%)	13.01 (74.6%)
At time of Ex-post Monitoring					
Item		2003/04	2004/05	2005/06	2006/07
1. Power Generation (kWh/1 N m^3 of Natural Gas)	Plan	2.39	2.39	2.39	2.39
	Actual	2.57 (107.5%)	2.88 (120.5%)	2.85 (119.2%)	2.90 (121.3%)
2. Thermal Efficiency at the Generating End (%)	Plan	(not specified)			
	Actual	25.27	28.34	27.97	28.53
3. Natural Gas Consumption per 1 ton of Urea Produced (N m^3)	Plan	868	868	868	868
	Actual	1,217 (71.3%)	1,183 (73.4%)	1,366 (63.5%)	1,264 (68.7%)
4. Cooling Water Consumption per 1 ton of Urea Produced (ton)	Plan	9.70	9.70	9.70	9.70
	Actual	15.18 (63.9%)	15.17 (64.0%)	17.16 (56.5%)	14.92 (65.0%)

Source: Ex-post Evaluation Report (at time of Ex-post Evaluation: Upper), Answers on Questionnaire (at time of Ex-post Monitoring: Lower)

(2) Control of Ammonia Leakage

Industries Corporation, the executing agency for the project).

At the time of ex-post evaluation, the observed value for the concentration of ammonia in water subject to DOE standards[2] was 0.15-5.0 ppm in FY2002/2003.[3] The concentration of ammonia in the atmosphere over the same time period ranged between 5.0-60.0 ppm, falling below the target of 45 ppm most of the time. At the time of ex-post monitoring, the observed values for the concentration of ammonia in water and atmosphere subject to DOE standards have met the standards, as is shown in Table 2 below.

On the other hand, the values for the concentration of ammonia in water not subject to DOE standards are observed to be high compared to the time of ex-post evaluation,[4] ranging toward the maximum values. The increase in the number of shutdowns resulted in large amounts of ammonia collecting in drain pipes, and these values were recorded temporarily when those pipes were cleaned, flushing their contents into the facility's artificial lagoon. According to the explanation given by the fertilizer factory, normally the concentration ranges between 200 ppm and 300 ppm, so this is not a big issue. Furthermore, just as at the time of ex-post evaluation, environmental monitoring of the artificial lagoon is not subject to DOE standards and is considered to be one of the processes necessary in carrying out waste water treatment for the Sitalakhya River adjacent to the factory. For this reason, no measures have been taken to reduce the ammonia concentration in the artificial lagoon to a level acceptable to DOE standards. But before discharging to Sitalakhya river, the water (lagoon outlet) is being diluted with fresh water to DOE standards.

Table 2: Environmental Monitoring Data (unit: ppm)

Item / Year	Subject to DOE Standards		Not Subject to DOE Standards
	Ammonia Concentration in Water (Monitoring point: 50m downstream from the drain outlet from the artificial lagoon to the river)	Ammonia Concentration in Atmosphere (Monitoring point: urea plant)	Ammonia Concentration in Water (Monitoring point: drain outlet to the artificial lagoon)
1999/00	N/A	N/A	100-400
2000/01	N/A	N/A	80-300
2001/02	0.25-5.0	10.0-80.0	50-275
2002/03	0.15-5.0	5.0-60.0	50-250
2003/04	0.03-5.0	N/A	72-1,820
2004/05	0.07-4.8	N/A	110-1,860
2005/06	0.07-5.0	2.0-75.0 *Note	152-1,902

[2] The limits for the concentration of ammonia stipulated by the DOE (Department of Environment of Bangladesh): 5 ppm or below for water and 50 ppm or below for the atmosphere.
[3] The data indicate the range between the minimum and maximum values recorded each year.
[4] The monitoring result in FY2002/03 was 50-250 ppm.

2006/07	0.08-5.0	2.0-12.0	159-2,171
2007/08	0.18-5.0	2.0-8.0	142-1,802

Source: Executing Agency documents
Note) A maximum value of 75.0ppm was observed but according to the fertilizer factory this was caused by an emergency shutdown of the urea plant (on the day of the observation the remaining ammonia was discharged, so the observed amount of ammonia increased temporarily), and therefore this was an exceptional case.

Figure1: Artificial Lagoon (adjacent to the fertilizer factory)

Figure 2: Ammonia Plant in the Fertilizer Factory

Furthermore, there are not any particularly big problems regarding environmental measures for the artificial lagoon, which was pointed out at the time of ex-post evaluation.[5] In this survey, it was confirmed that the Ghorasal Urea Fertilizer Factory was handling the issue appropriately. For example, in the dry season when the amount of water in the lagoon decreases due to evaporation, the factory adds water to the lagoon to prevent it from giving off the odor of ammonia, and in the rainy season when the amount of water in the lagoon increases, the factory uses a drainage pump to discharge water appropriately into the adjoining Sitalakhya River (adjusting the amount of water in the artificial lagoon). The factory also implements regular water quality monitoring for the lagoon (implemented once a week).

2.1.2 Impact

(1) Improvements of Living, Social, and Living Environment in the Region (Beneficiary Survey)

Table 3 below shows the results of a beneficiary survey of residents living within 2-3 km of the Ghorasal Urea Fertilizer Factory.[6] In general, no major changes are seen compared to the beneficiary survey results at the time of ex-post evaluation, but a

[5] The Ex-Post Evaluation Report stated, “in the dry season when the water level declines, the ammonia concentration in water may increase and the evaporated ammonia may give off an odor. In the rainy season, on the other hand, the excess water in the lagoon may flood adjacent areas, as has happened in the past.” Environmental measures were proposed to reduce the impact on local residents.

[6] The survey was conducted on the issue of “change compared to five years ago (= the change from the time of ex-post evaluation).” 100 people were ramdomly selected. (=the sample size is 100.)

significant number of residents has reported that they still notice an ammonia odor, indicating that concerns about health continue to exist.

Just as at the time of ex-post evaluation, the residents living on the north and northeast side of the Ghorasal Urea Fertilizer Factory and artificial lagoon notice the ammonia odor more and were more likely to be concerned about the environment impact of the factory than residents in other areas. One reason for this is that these areas are adjacent to the artificial lagoon, but another reason is that monsoons from the south (in winter) and southwest (in summer) blow the odor of the fertilizer factory to the north and northeast, so the residents in these areas notice the ammonia odor relatively more, and as a result tended to have more concerns about the environment.

Table 3: Results of the Beneficiary Survey

A. Impact on the Environment						
Question	Before Project Completion	%	At time of Ex-post Evaluation	%	At time of Ex-post Monitoring	%
1.Degree of Environmental Pollution (Degree of environmental pollution from Ghorasal Urea Fertilizer Factory)	Serious /Considerable	62	Improved Significantly	39	Improved Significantly	2
	Some/A little	34	Improved to Some Extent	59	Improved to Some Extent	48
	None	4	Deteriorated to Some Extent	0	Deteriorated to Some Extent	8
	-	-	No Change	2	No Change	42
2.Damage to Livestock (animals and fish) (multiple answers)	Cattle	20	Cattle	3	Cattle	13
	Poultry	66	Poultry	22	Poultry	22
	Fish	95	Fish	20	Fish	18
3.Damage to Fish in the Sitalakhya River and the Surrounding Areas	Serious /Considerable	65	Serious /Considerable	9	Serious /Considerable	17
	Some/A little	19	Some/A little	39	Some/A Little	52
	None	16	None	52	None	31
4.Water Pollution in the Sitalakhya River and the Surrounding Areas	Serious /Considerable	69	Serious /Considerable	45	Serious /Considerable	14
	Some/A Little	11	Some/A Little	47	Some /A Little	41
	None	20	None	8	None	45
5.Damage to Vegetation	Serious /Considerable	70	Improved Significantly	42	Improved Significantly	17
	Some/A Little	17	Improved to Some Extent	39	Improved to Some Extent	49
	None	13	None	19	None	34

B. Impact on Human Health

Question	Before Project Completion	%	At time of Ex-post Evaluation	%	At time of Ex-post Monitoring	%
1.Degree of the Ammonia Odor	Serious	57	Serious	3	Serious	26
	Some/A little	41	Some/A little	67	Some/A little	55
	None	2	None	30	None	19
2.Damage Condition to Health due to the Ammonia Odor	Serious	35	Serious	4	Serious	6
	To some extent/A little	65	To some extent/A little	43	To some extent/A little	49
	None	0	Little	51	Little	45
	-	-	None	2	None	0

Source: Results of Beneficiary Survey

Note: The left and center column shows results of the beneficiary survey implemented at the time of ex-post evaluation. The right column shows the result of the beneficiary survey at this time.

(2) Improvement of Urea Fertilizer Production Capacity

Regarding actual urea fertilizer production and the capacity utilization ratio, as shown in Table 4, production is slightly lower than at the time of ex-post evaluation (average of 70%-80%). The number of annual operating days has been maintained at almost the same level as it was at the time of ex-post evaluation. As previously stated, the main reason for actual urea fertilizer production being 70-80% of the planned value is the obsolescence of factory equipment and machinery, which leads to a large number of shutdowns, affecting the ability of the production line to operate according to plan. According to a management officer at the fertilizer factory, there have been a large number of shutdowns since the time of ex-post evaluation[7] and large-scale replacement and comprehensive renovation of equipment and machinery are necessary for the factory.

In August 2007 a gas compressor, a key piece of equipment in the urea fertilizer production process, was damaged in a fire.[8] Repair work on the gas compressor took approximately two years and ended in August 2009,[9] but in the meantime the production line was completely shut down. As a result, annual production in FY2007/2008 was 21.87 thousand tons, much lower than the previous year. Moreover, there was no urea fertilizer production at all in FY2008/2009.[10] At the time of this survey it was confirmed that the repairs had been completed and the gas compressor and the production line were operating normally, causing the level of production of urea fertilizer to return to the level

[7] There were 17 shutdowns in FY2005/06 and 20 shutdowns in FY2006/07. There were also two shutdowns in FY2007/08. (A gas compressor was damaged in August 2007, resulting in the production line operating only about 20 days. In other words, the number of shutdowns was “2 times/about 20 days.”) The fiscal year in Bangladesh is from July to June the following year.

[8] Regarding the cause of the fire, according to Ghorasal Urea Fertilizer Factory, “the precise cause is unknown, but some oil leaked out of the gas compressor and was somehow ignited (the cause of ignition is unknown).”

[9] It took a long time to complete repairs because the damaged gas compressor had to be dismantled and its parts shipped overseas (to Malaysia, the United States, etc.).

[10] During the production line shutdown, maintenance and inspections of the facilities and equipment were carried out as usual.

before 2007.

Table 4: Data related to Urea Fertilizer Production

At time of Ex-Post Evaluation					
Item		1999/00	2000/01	2001/02	2002/03
1. Urea Production (ton/day)	Plan	-	-	1,422	1,422
	Actual	1,146	1,107	1,132	1,168
2. Capacity Utilization Ratio* (%)	Plan	-	-	100	100
	Actual	80.59	77.85	79.61	82.14
3. Annual Operating Days (operating days/year)	Plan	-	-	330	330
	Actual	280.88	276.70	286.91 (86.9%)	322.82 (97.8%)
4. Annual Production (thousand tons)	Plan	-	-	470	470
	Actual	321	306	324 (68.9%)	377 (80.2%)

At time of Ex-Post Monitoring						
Item		2003/04	2004/05	2005/06	2006/07	2007/08
1. Urea Production (ton/day)	Plan	1,422	1,422	1,422	1,422	1,422
	Actual	1,113	1,134	1,024	1,038	936
2. Capacity Utilization Ratio* (%)	Plan	100	100	100	100	100
	Actual	78.27	79.75	72.01	73.00	65.82
3. Annual Operating Days (operating days/year)	Plan	330	330	330	330	330
	Actual	295.21 (89.5%)	308.31 (93.6%)	264.68 (80.2%)	320.48 (97.1%)	23.37 (7.1%)
4. Annual Production (thousand tons)	Plan	470	470	470	470	470
	Actual	329 (69.9%)	350 (74.5%)	271 (57.7%)	333 (70.8%)	22 (4.7%)

Source: Ex-post Evaluation Report (at time of Ex-post Evaluation: Upper), Answers on Questionnaire (at time of Ex-post Monitoring: Lower)

*The value with parentheses under the “Actual” value indicates achievement degree against the “Plan”.

*Note) The definition and calculation method of Capacity Utilization Ratio (%) in this table are “(Actual value of the urea production (ton/day) / Plan value of the urea production (ton/day)) × 100”.

Figure 3: Work for Delivery of the Urea Fertilizer (before being packed in bags)

Figure 4: Shipment of the Urea Fertilizer

(3) Actual Condition of Domestic Production and Supply of Urea Fertilizer

As shown in Table 5, the total domestic urea fertilizer supply in Bangladesh since the time of ex-post evaluation is approximately 2.3 to 2.7 million tons per year. The domestic production (total production for the six domestic fertilizer factories) is approximately 1.4 to 1.9 million tons per year. As shown in Table 5, domestic supply has been increasing a little. This has been achieved by supplementing domestic production, which tends to be insufficient, with imports. The fall in the FY2007/2008 production of the Ghorasal Urea Fertilizer Factory, as stated above, was due to the influence of a production line stoppage caused by damage to the gas compressor. As a result, there was a fall in domestic production that year.

Table 5: Domestic Supply of Urea Fertilizer and Production at Ghorasal Urea Fertilizer Factory (unit: 1,000 tons)

Item	At time of Ex-post Evaluation		At time of Ex-post Monitoring				
	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Domestic Production	1,546	2,057	1,982	1,878	1,730	1,817	1,477
Domestic Supply	2,066	2,239	2,324	2,523	2,451	2,528	2,763
Production at Ghorasal Urea Fertilizer Factory	324	377	329	350	271	333	22
Import[11] (incl. KAFCO[12])	520	182	342	645	721	711	1286

Source: Ex-post Evaluation Report and Executing Agency documents

The urea fertilizer import price ranges from Tk 21,000 to Tk 26,000/ton (and averages Tk 25,000/ton). According to the management officers of the Executing Agency (the Bangladesh Chemical Industries Corporation) and the fertilizer wholesalers, the higher the volume of imports of urea fertilizer the more difficult the financial position of the producers becomes (it is by purchasing the fertilizer at a higher price than the domestic

[11] "Import" includes a small amount of stocks from the previous year.

[12] KAFCO (Karnaphuli Fertilizer Company) is an export-oriented joint venture corporation of foreign capital located in Chittagong, Bangladesh's second-largest city. The firm is an affiliated company of the Bangladesh Chemical Industries Corporation, just over 40% owned by the Bangladesh Chemical Industries Corporation and just over 30% owned by KAFCO Japan which was established with investments from Japan (JBIC, Marubeni Corporation and Chiyoda Corporation). KAFCO is required to sell fertilizer at the export price even in Bangladesh because under a condition of the loan agreement it is required to export all of its products.

sales price[13]). Furthermore, domestically produced urea fertilizer has a good reputation for its quality, so the demand is high in the fertilizer market of Bangladesh. It is expected in the future that the market will be activated if production of urea fertilizer increases.

(4) Interview with Fertilizer Distributors

Table 6 below shows the results of the interview survey with the distributors (wholesalers) that handle urea fertilizer produced by the Ghorasal Urea Fertilizer Factory.[14] The results show that, just as at the time of ex-post evaluation, the urea fertilizer produced by the fertilizer factory scored highly in meeting the demands of the market, in quality, and in other categories.

Table 6: Results of the Interviews with Fertilizer Distributors

Question	Answer		
1. Does UFFL urea fertilizer meet the demands of the market (especially, in light of the fertilizer quality)?	Yes, very much: 9	Yes, to some extent: 1	No: 0
2. Have urea fertilizer sales of Ghorasal Urea Fertilizer Factory increased since the ex-post evaluation?	Yes, significantly increased: 1	Yes, to some extent: 3	No: 6
3. Has the number of employees increased since the ex-post evaluation?	Yes, significantly increased: 1	Yes, to some extent: 3	No: 6
4. What is your view of the future trend in fertilizer use in Bangladesh?	Promising: 10	Skeptical: 0	Pessimistic: 0
5. What do you think of the price level of urea fertilizer of Ghorasal Urea Fertilizer Factory?	High:1	Reasonable: 9	Low: 0

Source: Results of the Interviews with Fertilizer Distributors (10 companies answered)

Furthermore, a simple interview survey for the farmers living in the area around the Ghorasal Urea Fertilizer Factory (sample size of 17) was also conducted. More than two-thirds of the respondents were actually using urea fertilizer from the Ghorasal Urea Fertilizer Factory. All respondents stated that the quality of the fertilizer was “extremely good.”

2.2 Sustainability

2.2.1 Operation and Maintenance Agency

[13] For details refer to “Sustainability, (3) Financial Status for Operation and Maintenance”

[14] The survey was conducted on the issue of “change compared to five years ago (= the change from the time of ex-post evaluation).”

2.2.1.1 Institutional Structure for Operation and Maintenance

Just as at the time of ex-post evaluation, the Executing Agency for the project is the Bangladesh Chemical Industries Corporation, while the Ghorasal Urea Fertilizer Factory is in charge of operating and maintaining the facilities. The Ghorasal Urea Fertilizer Factory is a state-run fertilizer factory under the umbrella of the Bangladesh Chemical Industries Corporation.[15] As of September 2009, the Ghorasal Urea Fertilizer Factory has 922 employees. The factory is comprised of seven departments (the Operation Department, the Maintenance Department, the Technical Department, the Commercial Department, the Administration Department, the Finance and Accounting Department and the Civil Engineering Department) which are led by the head of the factory (the Managing Director).

One recent matter for concern is the increase in the number of employees who are quitting. According to the head of the factory, "a particularly large number of younger employees are quitting." The main reason for this is that the salary system for state-run fertilizer factories like the Ghorasal Urea Fertilizer Factory is determined by the government. Many young employees leave because they do not feel that the salary system is attractive (the salary level is low compared to private sector companies[16]).

Another matter for concern is that nearly all of the members of management are to reach mandatory retirement within two years[17] and there are no officers in the younger generation that can be promoted to manager in that time (for the reasons that there are not many to begin with, and that those who would have been eligible had already quit). According to management officers, "The employee distribution structure has been affected[18] and there is the possibility that if this problem is not resolved within two years, the factory will have a hard time continuing on."

Finally, the "Quality Control and Environmental Pollution Control Section" which was established with the objective of preventing ammonia leakage, is comprised of and operated by highly experienced employees, just as it was at the time of ex-post evaluation.[19] This section is a lower branch of the Technical Department of the Ghorasal

[15] There are six fertilizer factories, including the Ghorasal Urea Fertilizer Factory, under the umbrella of the Bangladesh Chemical Industries Corporation. All of them are state-run fertilizer factories. In addition, the BCIC has a paper-manufacturing company and a cement-manufacturing company.

[16] According to the management officers of the fertilizer factory, the salary level at the Ghorasal Urea Fertilizer Factory is approximately one-fifth that of the private fertilizer company, KAFCO.

[17] The mandatory retirement age is 57 years old. Personnel systems are also determined by government regulations.

[18] According to the interview result, "in the 1970s and the first half of the 1980s there were large profits from fertilizer sales and the salary system was attractive, so many people came to work at the factory. However, since around the middle of the 1980s salaries have become gradually less attractive compared to private sector companies, while at the same time no major changes have been made to the salary system. As a result, imbalances have arisen between the number (work class) of employees that joined the factory in the 1970s and the first half of the 1980s and those that have joined since about the middle of the 1980s."

[19] However, the head of this organization, the Deputy Chief Chemist, quit in 2008, and his post is still

Urea Fertilizer Factory, and has 33 employees as of September 2009.

2.2.1.2 Technical Capacities for Operation and Maintenance

There are no problems related to the plant's technical capacities. The Technical Department of the Ghorasal Urea Fertilizer Factory is in charge of personnel education and training programs for employees. In FY2006/2007 a total of 19 educational and training programs were implemented (over a total of approximately 346 days; approximately 58 employees participated in these programs), and in FY2007/2008 a total of 11 education and training programs were implemented (over a total of approximately 220 days; approximately 40 employees participated in these programs). Just as at the time of ex-post evaluation, most education and training are carried out by TICI.[20] There is not much education oriented toward management due to budgetary constraints.

Training through OJT is also being implemented. In the case of new employees, after they receive three months of education at TICI, they also receive OJT training in three departments in the Ghorasal Urea Fertilizer Factory for a total period of nine months of OJT training. (After training they are deployed to the department which they were judged to be most suitable for during OJT.)

2.2.1.3 Financial Status

(1) Operating Income and Operating Costs

Changes in the sales volume of urea fertilizer and operating costs since the time of ex-post evaluation follow:

・Sales Volume of Urea Fertilizer: As shown in Table 7, the sales volume of urea fertilizer was 306,514 tons in FY2006/2007, almost the same level as the time when the project was completed. However, in FY2007/2008 it was much lower at 67,301 tons. The reason for this, as stated above, is the shutdown of the production line due to a gas compressor fire in August 2007, which meant that in that fiscal year the production line was actually operating for only about 20 days, resulting in a much lower production level.

・Sales Income: Since the time of ex-post evaluation, the urea fertilizer price (the retail price) has continued to be controlled at Tk 4,800/ton, so sales income has been entirely dependent on sales volume. The reason for the fall in sales income in FY2007/2008 was the shutdown of the production line noted above. However, in June 2008 the retail price was revised to Tk 10,000/ton. As a result, it is highly likely that factory income will

vacant. The factory is currently trying to recruit a suitable person for the post who is highly experienced and has outstanding management skills.

[20] TICI (Training Institute of Chemical Industries) is a governmental education and training organization under BCIC. It mainly provides education and training in the chemical and industrial fields. Its educational facility is adjacent to the site of the Ghorasal Urea Fertilizer Factory.

increase going forward. It is explained under "(2) Financial Status of Ghorasal Urea Fertilizer Factory" on the next page for more details.

・Production Cost: The production cost per 1 ton has risen further since the time of ex-post evaluation as a result of rises in the cost of raw materials, natural gas, personnel expenses and packing material expenses. The production cost per 1 ton in FY2006/2007 was Tk 6,862 and the operating cost per 1 ton was Tk 7,450.[21]

Table 7: Operating Income and Operating Costs

At time of Ex-post Evaluation					
Item	1999/00	2000/01	2001/02	2002/03	
1. Sales Volume of Urea Fertilizer (ton/year)	324,634	328,678	303,334	350,809	
2. Urea Price (Wholesale Price) (Tk/ton)	4,816	4,804	4,801	4,800	
3. Sales Income (1,000Tk/year)	1,562,941	1,578,819	1,456,256	1,683,885	
4. Operation costs (1,000Tk/year)	1,943,940	2,023,062	2,087,363	2,068,773	
5. Operating Profit (1,000Tk/year)	(380,999)	(444,243)	(631,107)	(384,888)	
At time of Ex-post Monitoring					
Item	2003/04	2004/05	2005/06	2006/07	2007/08
1. Sales Volume of Urea Fertilizer (ton/year)	325,701	369,120	285,614	306,514	67,301
2. Urea Price (Wholesale Price) (Tk/ton)	4,800	4,800	4,800	4,800	4,800 (10,000) *Note 1
3. Sales Income (1,000Tk/year)	1,573,800	1,783,097	1,374,436	1,472,928	327,960
4. Operation costs (1,000Tk/year)	2,354,322	2,364,004	2,404,208	2,283,760	1,797,023
5. Operating Profit (1,000Tk/year)	(780,522)	(580,907)	(1,029,772)	(810,832)	(1,469,063)

Source: Ex-post Evaluation Report (at time of Ex-post Evaluation: Upper), Answers on Questionnaire (at time of Ex-post Monitoring: Lower)
Note 1) The urea price has been revised to 10,000 Tk/ton since June 2008.

(2) Financial Status of Ghorasal Urea Fertilizer Factory

Since the time of ex-post evaluation more deficits have been posted, the cumulative deficit has risen and the financial status of the factory has worsened further. The major reason for deficit, as stated above, is that production costs and operation costs have been

[21] Production cost/ton = annual operation cost/annual fertilizer production; operation cost/ton = annual operation cost/annual fertilizer sales volume

higher than the retail price (Tk 4,800/ton), resulting in permanent deficits.

However, in June 2008 the retail price of urea fertilizer was revised by government policy, from Tk 4,800/ton to Tk 10,000/ton. As a result, it is expected that the financial situation will improve from FY2009/2010 onwards.[22] Nonetheless, as previously stated, the Ghorasal Urea Fertilizer Factory frequently experiences shutdowns due to the obsolescence of equipment and machinery. Some aspects of the factory's financial status will depend on future production capacity.

Table 8: Profit and Loss Statement of Ghorasal Urea Fertilizer Factory (unit: million taka)

Item	2001/02	2005/06	2006/07	2007/08
1. Sales	1,529	1,374	1,473	328
2. Cost of Sales	1,731	2,293	2,135	1,676
3. Gross Profit	(202)	(918)	(662)	(1,348)
4. Selling and Administrative Expenses	119	112	148	121
5. Operating Profit	(321)	(1,030)	(811)	(1,469)
6. Non-operating Income (miscellaneous income, etc.)	127	104	102	39
7. Non-operating Expenses (interest expenses, etc.)	146	231	223	241
8. Ordinary Profit before Taxes	(340)	(1,157)	(932)	(1,671)
9. Corporate Taxes, etc.	-	6.87	3.68	-
10. Current Net Profit	(340)	(1,164)	(936)	(1,671)
11.Balance Brought Forward	(624)	(3,071)	(4,235)	(5,171)
12.Prior Period Adjustment	-	-	-	-
13.Unappropriated Income at End of Period	(964)	(4,235)	(5,171)	(6,842)
14. Transferred from Reserves	-	-	-	-
15. Balance Carried Forward	(964)	(4,235)	(5,171)	(6,842)

Source: Ex-post Evaluation (data on 2001/02), Answers on Questionnaire (data from 2005 to2008)

During the production line stoppage between August 2007 and August 2009, approximately 1,120 million taka was allocated from the government and the executing agency to make up for the loss (approximately 970 million taka from the government and approximately 150 million taka from the executing agency).

[22] Before the revision of the retail price, the production costs were higher than the retail price, resulting in a loss of 2,000-3,000 taka per 1 ton of production. The revision of the price to Tk 10,000/ton is expected to result in a profit of Tk 2,000-3,000/ton.

(3) Influence on Fertilizer Distributors and Farmers due to the Revision of the Retail Price of Urea Fertilizer

As previously mentioned, in June 2008 the retail price of urea fertilizer was revised to Tk 10,000/ton. This change resulted in corrections to the two-tier pricing system and the elimination of brokers from the fertilizer trade (see Figure 5). It has given a significant influence on urea fertilizer sales and distribution systems. Meanwhile, it has had little effect on the retail price for farmers. It is difficult to get a detailed picture of the situation for this survey due to time issues and other constraints, but as shown in Figure 5, the retail price for farmers after the revision is not very different compared to the retail price before the revision. It seems that the revision was largely accepted. The government is strongly committed to monitoring and controlling the sales and distribution systems of fertilizer through the National Fertilizer and Seed Monitoring Committee.[23]

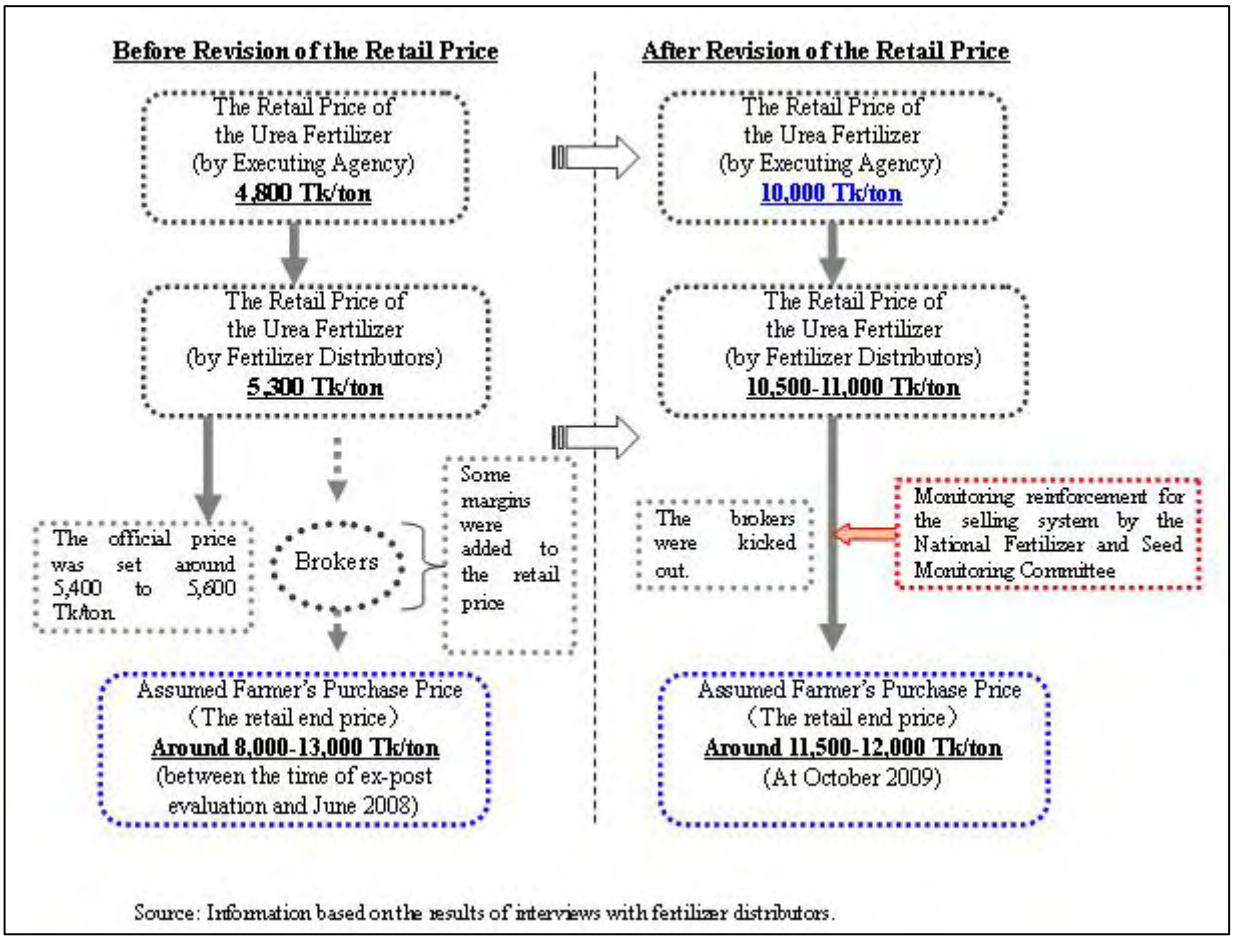


Figure 5: Change of the Selling and Distributing System due to the Revision of the Retail Price of Urea Fertilizer (Outline)

[23] The Ministry of Industries in Bangladesh cooperates with the other government ministries and agencies to run this committee.

2.2.2 Conditions of Operation and Maintenance

The conditions of operation and maintenance have not changed much since the time of ex-post evaluation. Despite having budget and staffing constraints, the Ghorasal Urea Fertilizer Factory has been implementing as much maintenance as it can. As previously stated, personnel-related problems, such as a lack of employees (the number of employees quitting their jobs is gradually increasing), are getting worse. It is inferred that this will have an influence to some extent on maintenance operations.

・Maintenance Plan: At the time of ex-post evaluation there were no long-term maintenance plans in place or benchmarks for performance. Since then, manuals for shutdowns and overhaul have been developed, as has a maintenance plan. The factory now has a plan for preventive maintenance and a maintenance plan for use when an overhaul is being carried out. Furthermore, inspections of equipment and machinery are being carried out based on standardized manuals and maintenance plans. However, as noted, the outflow of human resources is a cause for concern.

・Preventive Maintenance: Although the need for preventive maintenance was recognized at the time of ex-post evaluation, a structure to support such maintenance was not established. By the time of ex-post monitoring, a plan for preventive maintenance was developed, but the plan is found to be inadequate due to the shortage in highly experienced employees and new maintenance supplies. This is also mentioned in the “Spare Parts” section below, but the procurement of parts and machinery in particular takes time. Even though preventive maintenance is perceived to be necessary, progress has not been made on this issue due to the shortage of parts and delays in procuring them.

・Quality Control: At the time of ex-post evaluation the importance of quality control was not fully recognized. Employees prioritized annual production targets and had little awareness of cost-management. Furthermore, there were no benchmarks for quality control. On the other hand, at the time of ex-post monitoring, it was found that a strong commitment to quality control existed. Maintenance operations are being carried out under a 3-shift (24-hour) structure, and quality control inspections are being carried out during each shift. Operation manuals are in the process of being developed as well. Employees are aware of the importance of quality control. However, as the facilities are becoming more obsolete, the level of quality control is not always satisfactory.

・Spare Parts: At the time of ex-post evaluation, the executing agency’s procedure for the procurement of spare parts was judged to be inefficient and often prevented the timely procurement of necessary spare parts. At the time of ex-post monitoring, just as at the time of ex-post evaluation, necessary spare parts are being procured through procedures that in many cases still requires much time until completion of delivery. This preventes

the timely procurement of the necessary parts.

・Information Management: At the time of ex-post evaluation, documents and other materials were not managed systematically, and there was no clear maintenance history for machinery and equipment. At the time of ex-post monitoring, there is awareness that information management is still inadequate, but the factory is making efforts to improve information management, including the purchase of a batch of computer supplies in 2005 and 2006, and the establishment of LAN systems in some departments.

Figure 6: Gas Compressor after the Repair

Figure 7: Inside View of Ghorasal Urea Fertilizer Factory

3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

Since the time of ex-post evaluation, the Government of Bangladesh has revised the retail price of urea fertilizer with the aim of improving the financial structure of domestic fertilizer factories, including the Ghorasal Urea Fertilizer Factory. At the same time, the Ghorasal Urea Fertilizer Factory has been strongly committed to maintenance and inspection and to quality control, and has made efforts to improve information management, including the purchase of a batch of computer supplies, which have been used to establish local area networks. However, the project faces the problem that 40 years have already passed since the fertilizer factory commenced operations. The facilities at the factory are becoming obsolete, resulting in an increasing number of shutdowns. This has made it difficult to achieve actual urea fertilizer production according to plan. The revision of the retail price of fertilizer means that financial improvement may be expected going forward if production capacity can be ensured. It is vital that the recommendations in the below paragraph should be implemented in order to ensure the necessary production capacity.

3.2 Lessons Learned

None

3.3 Recommendations

[To the Executing Agency and Ghorasal Urea Fertilizer Factory]

■The equipment and machinery in the Ghorasal Urea Fertilizer Factory is becoming more and more obsolete, and the number of shutdowns is increasing. It makes it difficult to achieve actual urea fertilizer production according to plan. The Executing Agency and the fertilizer factory should put into place an operation and maintenance structure that will ensure normal operation by reducing the problems of the facilities overall. The factory should continue its strong commitment to the maintenance and inspection of equipment and machinery and continue to replace and renovate facilities.

■The factory should implement efforts to secure human resources and retain its current employees as soon as possible.

■A system should be constructed to support the procurement of necessary spare parts without delay. Furthermore, steps should be taken to bolster the implementation system for preventive maintenance and the maintenance plan.

Comparison of Original and Actual Scope

Item	Plan	Actual
1) Output	(1) Upgrading of the Ammonia Plant	=>Almost as planned (Changes) - Repair and cleaning of the spare boiler in the reforming section were cancelled. - Replacement of the air intake tower in the air compression section was cancelled. - Installation of process compression equipment in the compound section was cancelled.
	(2) Upgrading of the Urea Plant	=>Almost as planned (Changes) - Replacement of the wooden chamber in the urea granulation section was cancelled.
	(3) Installation of a 16MW Gas Turbine Power Generator	=>Almost as planned (Changes) - The power generation capacity was increased to 18MW
	(4) Upgrading of Ancillary Facilities	=>Almost as planned (Changes) - Installation of a conveyer belt in the fertilizer storage area was cancelled.
2) Project Period	July 1999 to May 2001 (23 months)	July 1999 to September 2001 (27 months)
3) Project Cost Foreign Currency Local Currency Total ODA Loan Portion Exchange Rate	 5,443 million yen 1,018 million yen (393 million Tk) 6,461 million yen 5,443 million yen 1 taka = 2.59 yen (December 1998)	 5,443 million yen 1,000 million yen (497 million Tk) 6,443 million yen 5,443 million yen 1 taka = 2.01 yen (2000)

India

Ex-Post Evaluation of Japanese ODA Loan Project

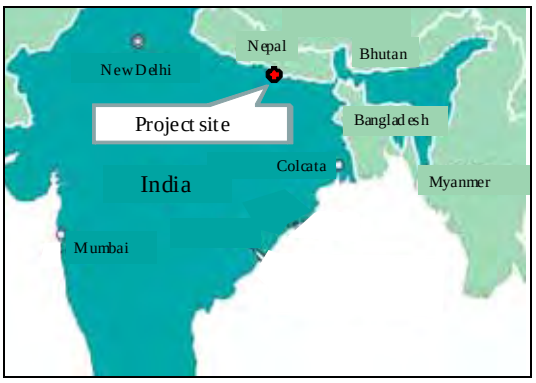
"Eastern Gandak Canal Hydroelectric Project"

Third Party Evaluator: IC Net Limited

Kenji Momota

Field Survey: October 2009

1. Outline



Project site location

The power plant seen from downstream of the irrigation canal

1.1 Project Objective:

The objective of this project is to improve the electricity shortage of the state through low head hydropower generation[1] by constructing a bypass channel for power generation in the East Gandak irrigation canal in Bihar state, thereby contributing to regional economic development.

1.2 Project Outline (Outline of Loan Agreement):

Approved Amount/Disbursed Amount	1,630 million yen / 1,628 million yen
End Notes Exchange Date/Loan Agreement Signing Date	December 1984/July 1996
Ex-post evaluation	2003
Executing Agency	BHPC (Bihar State Electric Corporation)
Main Contractor	Sumitomo Corporation (Japan)

[1] Hydroelectric power generation performed with a dam of low height

(Over 1 billion yen)	
Main Consultant (Over 100 million yen)	None

1.3 Background/Reason for Post Monitoring

The total annual quantity of electricity generated in 2003(at the period of ex-post evaluation) remained less than thirty percent of that initially planned. The primary factor was due to design/structural problems of discharge canal of the plant. Outlet water level downstream of the power plant could not decrease sufficiently and the generating capacity did not reach the expected level. The ex-post evaluation report suggested that this problem could be resolved through establishment of an "escape channel" midway in the drainage channel, and recommended its rapid construction. Consequently, this project became subject to ex-post monitoring in order to reappraise the operating conditions of the power plant and the progress of outfitting the said escape channel since the ex-post evaluation. The ex-post monitoring was conducted in accordance with the distinct evaluation criteria based on the results of the recent field survey.

The field survey for this project was first scheduled for June. However, BHPC, the executing agency postponed the survey four times. It caused a significant delay in the schedule. In addition, parts of the data requested based on the questionnaire during the field survey were not provided. Thus a detailed analysis of these items was relinquished.

2. Monitoring Results

2.1 Effectiveness (Impact)

2.1.1 Quantitative Effects

2.1.1.1 Operation and Effect Indicators

(1) Operating Conditions of the Power Plant

With the total amount of electricity generated at around 20 - 30% of originally projected level and a capacity factor at 15 - 18%, no change in conditions is seen from the time of the ex-post evaluation. As per the following details, the primary factors are shortages in water quantity and insufficient outlet head etc.

Table 1 Results of Primary Operation and Effect Indicators for the Power Plant

Indicator/Year	2004	2005	2006	2007	2008
Operation Indicator					
1 Accidental outage (Hours/Year)	138.98	185.14	230.5	236.1	213.2

	Mechanical error	28.9	70.05	90.5	87.5	78.1
	Human Error			-	-	-
	Others	110.08	115.09	140.0	148.6	135.1
2	Operating rate	18.5%	20.6%	18.8%	16.0%	15.6%
	% of planned value(69% at time of planning)	26.8%	29.9%	27.3%	23.2%	22.7%
3	Planned outage (For Maintenance)	2,080	2,150	2,190	3,100	2,840
Effectiveness Indicators						
1	Total Power Generated (GWh/Year)	25.48	27.9	25.4	22.6	21.2
	% of Planned value	28.3%	31.0%	28.2%	25.1%	23.5%
2	Net Power Generated (GWh/Year)	24.28	27.07	24.7	21.1	20.6
3	Maximum Output (MW)	7	7.4	7.3	7	7
	% of Planned value(Max. 15MW)	46.7%	49.3%	44%	44%	44%

(Source: BHPC)

The reasons why there were not sufficient improvements in the operating conditions of the power plant have not been seen are as follows.

1) Insufficiency of water quantity

The rated output of the power plant is 15MW (5MWx3), with penstock water quantity of approx 297m^3/s necessary to operate all three power generators simultaneously. However, the water quantity diverted from the East Gandak irrigation canal is not maintained at this level. 198m^3/s is necessary to operate two generators simultaneously, but this level cannot be regularly secured. At the time of the field survey, just one generator operating at a water quantity of 99 m^3/s. BHPC engineers have recognized the cause as a decrease in water flow quantity due to silting in the irrigation canal, which is the source of the transmission water. The irrigation canals are under the jurisdiction of the Department of Water Resources and not the BHPC. BHPC has submitted application for silt removal operations. However, it has not been implemented for the past 15 years. BHPC staffs assume that the water level of the irrigation canals has decreased to 50% of planned level due to silting.

The BHPC engineers have also mentioned that this silting might cause the high water flow of the drainage channels as the irrigation canal is also the discharge point for the drainage channels. This is possibly the cause of the insufficient outlet head described in 2).

Although this problem was not raised at the time of the ex-post evaluation, the executing agency did not mention the conditions at that time. However, considering the fact that removal of silt for the irrigation canals have not been implemented for the past 15 years, a certain risk may have existed even though this problem had not surfaced at the time of

planning and starting operation of the power plant.

2) Insufficient water level of Outlet Head

This problem has already been identified at the time of the ex-post evaluation, and still no great changes were observed. Details are as follows.

1. The East Gandak hydroelectric plant generates power by using the outlet head. The rated head at time of design was set at 5.3m. However, the head, when two units operate simultaneously, is 4.3m, which is too small to operate the generators under optimum conditions. The cause of this is the water level of the drainage channel reaching the upper limit of design of 104.9m, as pointed out at the time of the ex-post evaluation. Sufficient water quantity could not let two generators operate simultaneously at maximum output because it would cause overflow from the canal.

2. The operating test carried out in 2003 by the supplier described that elevation of water level is an obstacle to the full operation of the generators. It recommended expansion of width and depth of drainage channel.

3. At the time of the field survey, the engineer stated that the cause of the current problems is the above 1-2 and that there is no problem with the condition of the power facilities themselves. Also the opinion of the Central Water Commission which designed the escape channel as detailed below supports the view of the supplier. Thus, the resolution of this outlet head problem is deemed the most effective measure to improve the operating conditions of the power plant.

Fig. 1 Present Condition of the Outlet (One Generator Operating)

Fig. 2 Present Condition of the Outlet (Opposite Side)

3) Present Condition of the escape channel

The present conditions of the escape channel, which was proposed by the ex-post evaluation, are as follows. Although a contract of its civil work was signed in 2007, actual construction has not yet begun and the start of construction has not yet been clearly scheduled.

1. The location for the channel has already been confirmed[2] and a contract of civil work was already signed in October 2007 (project cost: 230 million rupees). Also, the land acquisition has already reached agreement with respective landowners. (The compensation itself has not yet been paid.)
2. At present, the drainage channel has not been constructed and even the foundation work has not yet begun. According to the contractor, commencement of the civil work was planned for November 2009 after the end of the rainy season[3].
3. BHPC plans 50% of the budget from their own capital and thre rest to borrow from the National Bank for Agriculture and Rural Development (NABARD).
4. BHPC did not clearly answered to enquiries why construction was not commenced at the time of the ex-post monitoring, when two years or more had passed since the contract.

Fig. 3 Scheduled Location for Construction of the escape channel

Fig. 4 Primary Canal

(2) Position of the Project in the Total Power Distribution Network of the State

This power plant serves as a base load plant and is connected to the state grid except for the power supplied to the project area (approx.1MW). The share of the power generated by the plant is as follows, which only occupies less than 1% of the total power distribution

[2] The design of the drainage channel was created by the Central Water Commission (a research and study organization under the jurisdiction of the ministry of water resources)
[3] The work did not yet started as of November 2009

network of the State.

Table 2 Position of the Power Plant in the Total Power Distribution Network of the State

Item	Power generated (GWh) 2006-7	2007-8	2008-9
Whole state	9,629	11,134	12,874
BHPC Plant Total	111.45	90.85	95.95
East Gandak Power Station	25.33	20.67	19.14
% of Whole state	0.26%	0.19%	0.15%
% of BHPC Plant Total	23%	23%	20%

(Source: BHPC)

(3) Accidental outage

The rate of outage stays approx. 2.4 to 2.7% over the past few years, which remains under the standard rate[4] and seems to pose no particular problem.

Table 3 Transition of Unscheduled Shutdown Time for the Power Plant

Index	2004	2005	2006	2007	2008
Unscheduled Shutdown (Hours/Year)	138.98	185.14	231	236	213
Shutdown Rate	1.59%	2.11%	2.63%	2.70%	2.43%

(Source: BHPC)

(4) Recalculation of the Financial Internal Rate of Return (FIRR)

Recalculation of the FIRR was scheduled in this survey in accordance with the calculation method at the time of the ex-post evaluation. However, FIRR was not calculated this time since the requested data such as records of operation and maintenance costs was not provided from BHPC.

2.1.2 Qualitative Results

This item is explained in the subsequent paragraph 2.1.3 as it overlaps the evaluation of impact.

[4] According to the Manual on Planning Criteria confirmed at the ex-post evaluation report, 4.5% is the upper limit of the outage rate.

2.1.3 Impact

Although the originally planned quantity of power generation is not achieved, 1MW of the generated output is being supplied to the project area (Valmiki Nagar). In order to assess the impact of the supply of power to the project area, a beneficiary survey was conducted.

1) Target beneficiaries

- 99 electrified households, residing within a 10 km from the power plant (of which 18 are businesses) and 12 non-electrified households.
- 79% of household are below the poverty line (BPL[5]).
  (60% are of annual income 20,000 rupees or less, 40% are of annual income 100,000 rupees or less)
- A breakdown of the businesses includes tea processing, catering, electromechanical and rice production businesses, among others.

2) Survey Results

1. The principal purpose of electrification was to increase the time of education for children and the productivity of night-time household chores. Approximately 86% responded that they were “very satisfied” or “satisfied” with the level of achievement of the expected effects and goals due to electrification.

2. Approximately 83% of businesses replied that they were “very satisfied” or “satisfied” with the level of achievement of goals due to electrification. Also, 94% of these businesses replied that the economic level had improved by electrification. This probably reflects an improvement in productivity due to electrification. Additionally one electromechanical business replied that the number of customers had increased thanks to the increase in houses using electrical appliances due to electrification. It is thus fair to say that electrification has an impact in changing the business environment.

3. Meanwhile, 75% of households expressed discontent because of unstable electrical supply such as the occurrence of power outages on an almost daily basis. In addition, the occurrence of these power outages at the peak time of 6 - 10 PM aggravates the dissatisfaction.

[5] Below Poverty Line

Fig. 5 Level of Satisfaction with Electrification (71 Standard Households)

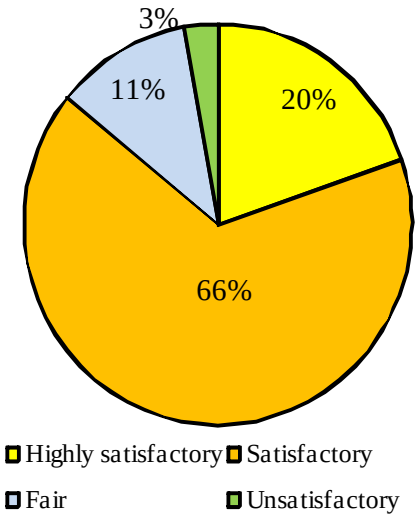
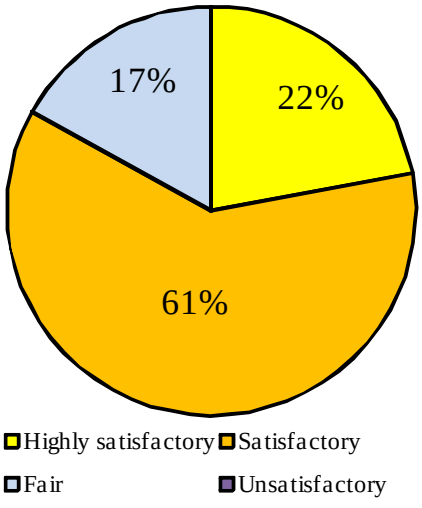


Fig. 6 Level of Satisfaction with Electrification (18 Businesses)



(Source: created based on the beneficiary survey)

From the above, it is observed that a certain number of local people enjoy the benefits of electrification by the project and improve their daily life and economic environment. Meanwhile, constant shortage of power supply and frequent occurrence of interruption (almost daily) are confirmed. Urgent countermeasures should be taken since improvements in the operating condition of the power plant would probably make a difference on this problem,.

Fig. 7 Appearance of the Beneficiary Survey (1)

Fig. 8 Appearance of the Beneficiary Survey (2)

[Summary of Effectiveness and Impact]

Majority of the power generated by the plant has been sent to the Bihar State Grid, and

part of the generation is supplied to the project area. Although this power distribution contribute to the improvement of electric power supply of the whole state to a certain extent, the project has not achieved satisfactory outcome, considering the fact that the power generated only reaches approx. 30% of the original plan.

As mentioned earlier, the deficiency in water quantity and outlet head have been hindering the optimal operation of the power plant, and the situation is deteriorating. Although the construction of escape channel may improve the insufficiency in outlet head, optimum performance is still unlikely to be achieved due to insufficient water quality. Concerning the deficiency in water quantity, it is necessary to improve the quantity of water in the irrigation canal, which is the source of the water transmission.

2.2 Sustainability

2.2.1 Operation and Maintenance Agency

2.2.1.1 Operation and Maintenance Management System

The personnel of the power plant number 15 with a breakdown as below. No great change is seen concerning the total number of personnel or their classification. In the on-site interview survey, power plant personnel responded that the current number of personnel is appropriate for the operation of the plant.

Table 4 East Gandak Canal Hydroelectric Plant - Personnel Structure

Position	At Ex-Post Evaluation (2003)	Current (October 2009)
Assistant chief engineer	1	1
Superintending engineer	2	1
Executive engineer	4	2
Assistant engineer	8	2
Outsourced Contract Personnel	25	44
Total	40	50

(Source: BHPC)

The operation of the plant is outsourced to the Patna-based Associated Engineering Centre. BHPC staff are primarily responsible for supervising outsourcers. The manager of the power plant stated that there is no great problem concerning the personnel structure and sufficient number of personnel is secured in order to maintain the power plant.

2.2.1.2 Technical level for Operation and Maintenance

1) There are no special problems concerning routine operations of the power plant. BHPC has operated 11 hydroelectric plants in addition to this one. It is reasonable to assume that BHPC is maintaining the plant at appropriate technical level.
2) However, BHPC claimed that final commissioning test of the generators was not implemented by the supplier at the time of delivery and it causes issues in support in occurrence of trouble.[6]
3) In the on-site interview survey, it was confirmed that the required training for personnel and education through OJT are carried out. In addition, staff periodically participate training of various education and research institutions (National Power Training Institute etc.)
4) The outsourcers also have experience of operating other BHPC power plants, therefore they are assumed to maintain sufficient technical level for the appropriate operation of the power plant. BHPC also considers there is no problem with the quality of outsourcers.

2.2.1.3 Financial Status of Operation and Maintenance Management

In the on-site interview, staff of the power plant responded that appropriate funds are allocated for the necessary operational costs. However, a detailed analysis of the current condition was not possible as detailed information relating to the financial statement was not provided.

2.2.2 Operation and Maintenance Conditions

1) As detailed in the chapter of Effectiveness, the deficiency in water quantity due to silt in the irrigation canal, which is the transmission water source for the power generation channel, has become a large problem. The capacity of the irrigation canal, which is under the jurisdiction of the Department of Water Resources, is declining as silt removal operations have not been carried out over the past 15 years.

2) No major problems are seen concerning the principal functions of the power facilities. If water quantity and outlet head can be improved, appropriate operation will be possible. However, a fault with the flow meter to monitor the quantity of flow has been reported.

[6] According to the report from supplier, final test was conducted on unit 1 and 2. Final test on unit 3, which had been installed after termination of L/A due to the significant delay of civil work, was not conducted by supplier as installation work was done by BHPC themselves.

Table 5 Status of Principal Power Facilities

Fig. 9 Irrigation Canal

Fig. 10 Appearance of the Inside of the Power Plant

3. Conclusion and Lessons Learned/Recommendations

3.1 Conclusion

Power generation still remains at around 30% of the original plan and almost no improvement was observed since the ex-post evaluation. Several factors affected this problem such as a deficiency in water quantity and issues in design. With initiatives to improve each problem delayed, no clear prospect toward improvements hereafter is observed.

3.2 Lessons Learned

The deficiency in drainage channel capacity is the cause of the deficiency in outlet head. As identified at the time of the ex-post evaluation, it is conceivable that a more careful survey such as carrying out more thorough simulations should have been conducted at the design stage.

3.3 Recommendations for the Executing Agency

1) As construction of an escape channel, which has been delaying from original schedule, seems one of the effective options for the operation of two generators, urgent implementation is desirable.

2) It is necessary to coordinate with the Department of Water Resources concerning the silt in the irrigation channel. Formal communication channel should be used, such as the establishment of regulatory functions between the top of the organisations.

Comparison of Original and Actual Scope

Item	Planned	Actual
(1) Output		
1)Headrace		
Length	1,067m	1,432m
Designed water depth	4.88m	As planned
2)Power Plant		
Installed capacity	5MW×3 Units=15MW	As planned
Type of hydraulic turbine	Valve-regulated tubular	As planned
Head (rated)	5.3m	5.1m (when only one generator is operated)
3)Drainage canal		
Length	3,230m	4,282m
Depth	3.2m	3.2m
(1) Project period		
Preparatory work	Nov.1983-Oct.1984	Not known
Land acquisition	Nov.1983-May.1984	1985-1990
Headrace and tailrace	Oct.1984-1987	1986-1993
Power plant	Oct.1984-Nov.1986	1988-1992
Equipment procurement	Dec.1983-Oct.1986	1984-1994
Switch yard construction	Feb.1985-May.1987	Completed in 1994
Installation of the plant	Aug.1986-Oct.1987	Completed in 1997
(2) Project Cost		
Foreign currency	1,630 million yen	1,628 million yen
Local currency	3,630 million yen (165 million Rupees)	2,192 million yen (226 million Rupees)
Total	5,260 million yen	4,225 million yen
ODA loan portion	1,630 million yen	1,628 million yen
Exchange rate	1 Rupee= 22 yen	1 Rupee=9.85 yen

India

Ex-Post Monitoring of Japanese ODA Loan Project

"Upper Kolab Irrigation Project"

Evaluator: Kenji Momota, IC Net Limited

Field Survey: June 2009

1. Outline of the Project

Site Map

Main Canal developed by the Project

1.1 Project Objective

The objective of this project (hereafter referred to as "the Project") was to increase agricultural production and improve productivity in the upstream area of Kolab River, a branch of the Godavari River in the state of Orissa, by constructing irrigation facilities in rain fed agriculture regions of low productivity, thereby contributing to the reduction of poverty through improving the earnings of scheduled castes and scheduled tribes (minority tribes) whilst increasing the food self-sufficiency of the state.

1.2 Project Outline (Outline of the Loan Agreement)

Approved Amount/Disbursed Amount	3,769 million yen / 3,114 million yen
Loan Agreement Signing Date / Final Disbursement Date	December 1988/July 1998
Ex-Post Evaluation	2003
Executing Agency	Department of Water Resources, Government of Orissa
Main Contract Only more than 1 billion	None

Consultant Contract Only more than 100 million yen or above	None

1.3 Background / Reason for Ex-Post Monitoring

According to the ex-post evaluation conducted in 2003, the area irrigated remained at a level of 21.4%~56.2% of planned level, especially in the dry season, and agricultural output also did not reach planned level. The background to this is a level of water consumption higher than projected and issues with water allocation, which arose due to inconsistencies in the farming programme. These were presumably related to such factors as the delay in the transfer of authority to the irrigation associations, which raised the necessity of promoting the participation of farmers in the maintenance of the farming programme and in the irrigation associations. Consequently, the Project became subject to Ex-Post Monitoring in order to review and verify the maintenance conditions of the irrigated areas from the ex-post evaluation onwards. The Project was reviewed with distinct evaluation criteria based on the results of the recent field survey etc. and a conclusion was derived.

2. Monitoring Results

2.1 Effectiveness (Impact)

2.1.1 Quantitative Effects

2.1.1.1 Operation and Effect Indicators

(1) Irrigated Area

At the time of the ex-post evaluation, the area irrigated did not achieve target levels in either the rainy or dry seasons. In particular, the level in the dry season remained at a maximum of 56.4% (1999) of projected levels. However, the current irrigated area in both the rainy and dry seasons has seen full-scale improvements from the time of the ex-post evaluation. In particular, the level in the dry season reached almost 100% of projected level.

Table 1 Area Irrigated Within the Project Area

(Unit: ha)

	Target	Project Completion	Until Ex-Post Evaluation			Since Ex-Post Evaluation to Present		
	Year	1998	1999	2002	2005	2006	2007	2008
Rainy Season	15,208	13,384	14,036	n.a	17,391	17,391	17,391	17,391
	Achievement	88.0%	92.3%	n.a	114%	114%	114%	114%

	Level							
Dry Season	12,116	4,290	6,835	4,529	12,417	11,655	11,936	11,749
	Achievement Level	35.4%	56.4	37.4%	102.5%	96.2%	98.5%	97.0%

(Source) Department of Water Resources, Government of Orissa

This trend can be attributed to the improvement of the issues raised during ex-post evaluation.

1) Improvement of Water Consumption and Allocation Plan

Due to the results of education by the Department of Water Resources and promotion of awareness-raising relating to water usage by the farmers, the habit of optimum water usage is spreading among the local people. In the beneficiary survey conducted during field survey (see Impact section for details), approximately 50% of farmers responded that they can secure sufficient water quantities at any time, with a little under 70% of the total responding that they can secure sufficient water quantity for a certain period. The beneficiaries confirmed that they realized improvement of conditions relating to water usage is also confirmed by the perception of the beneficiaries. Specifically, the following two main causes are possible.

1. The knowledge relating to appropriate water management and farmer awareness-raising is accumulating, through guidance visits to irrigation associations by Department of Water Resources staff.
2. Experience of using irrigation facilities has been accumulated.
3. Water consumption changed itself through advances in crop diversification such as the increased cultivation of crops of relatively low water consumption
4. Extension of efficient production technology progressed by farming guidance.

Considering the above, problems relating to water usage has been improving compared to the time of the ex-post evaluation.

2) Quantity of water of irrigation canal

With precipitation in the Project area that forms the water source for the irrigation and the average stream flow of the main canal, which are shown as follows, stable water quantity has been maintained in the last few years. The table below shows the annual rainfall for Orissa State for the past six years from the ex-post evaluation in 2002 onwards, precipitation has stabilised and the executing agency confirmed that there has been no

problem with water quantities.

Table 2 Annual Rainfall in Orissa State

(Unit: mm)

Year	2002	2003	2004	2005	2006	2007
Rainfall	1007.8	1663.5	1256.7	1497.7	1682.8	1583.2

(Source) Status of Agriculture in Orissa

Table 3 Flow of the Main Canal in the Project Area

(Unit: m^3/sec)

Year	Average Annual Flow	Rainy Season		Dry Season	
		Maximum	Minimum	Maximum	Minimum
2003-04	20.24	35.26	4.79	46.15	7.73
2004-05	22.96	36.02	4.63	39.73	9.34
2005-06	22.20	30.23	4.63	46.27	4.67
2006-07	23.85	35.48	3.50	38.69	4.57
2007-08	21.68	29.16	4.70	37.11	4.84
2008-09	20.33	34.53	2.45	37.11	9.18

(Source) Department of Water Resources, Government of Orissa (UKIP office)

However, the Satiguda Dam, water sources of the canal is under the control of state electric power corporation, and water use for irrigation is prioritized lower than power generation, which may cause large-scale water shortage for irrigation in the period of water shortage. According to the Department of Water Resources, allotment is decided whilst making suitable adjustments with the electric power corporation. However this is carried out through the interpersonal relationships of managers in the organisations and there is no opportunity for formal adjustments.

3) Improvement of the Farming Environment

In order to maximize the benefit of irrigation facility, activities such as dissemination of education for farmers, development of on-farm infrastructure, have been gradually developed, thereby improving the agricultural production.

1. Development of on-farm infrastructure

In order to distribute irrigation water efficiently, development of on-farm infrastructure such as development and maintenance of drainage facilities is necessary. Development of on-farm infrastructure was commenced by the Department of Water Resources under

government assistance (national and state) from 2005 together with agricultural land consolidation. Outfitting of approximately 25,000 ha (achievement rate 41%) is underway and is projected to be completed in 2011.

2. Various Agricultural Techniques for Crop Diversification and Yield Increase

Training is being conducted at the Department of Water Resources in cooperation with WALMI[1] affiliated with Department of Water Resources.

Table 4 Implementation Status of Land Consolidation and Training for Farmers

	Planned (2011)	Actual (As of March 2009)	Planned/Actual Ratio
Servicing of Outlying Agricultural Areas (Unit: 1,000ha)	59.644	24.584	41%
Training for Farmers (People)	n.a	8,900	n.a
Number of Training Programs	n.a	87	n.a

(Source) Department of Water Resources, Government of Orissa (UKIP office)

According to interviews with the Department of Water Resources and WALMI, these programs have not been connected with any remarkable reform at present since the production of rice is traditionally popular in this locality as identified at the time of the ex-post evaluation and it requires more time to bring about a change in mind-set of farmers who rely on rice production. However, as kinds and share of products continues to improve, progress of the initiatives for farmers inclined towards efficiency is observed through the introduction of industrial science and agricultural machinery etc. Therefore, further improvements can be expected through continuing initiatives.

(2) Planted Area of Main Crops/Yield

Yield in the Project area reached beyond the planned level in both rainy and dry seasons, and in particular that of dry season has drastically improved from approximately 46% at the time of ex-post evaluation to 101%. This can be attributed to the improvement of production environment, such as expansion of the actual irrigated land and development of on-farm infrastructure since the ex-post evaluation. The breakdown of Table 5 shows that

[1] WALMI=Water and Land Management Institute. Implements agricultural guidance and technology training for farmers and the cultivation of test products as an Agriculture Ministry affiliated agency.

vegetable production has drastically increased from a projected 256ha to 1,327ha (rainy season) although rice production still composes more than 80% of the structure. Increases are also seen in other products such as sugar cane, suggesting that product diversification has proceeded to a certain extent compared to the time of the ex-post evaluation.

Product diversification is also promoted with the intention of optimising water usage through increase of crops requiring comparatively low water consumption, such as vegetables. The Department of Water Resources prepares these plans in cooperation with the Agriculture Department, providing education and guidance for farmers based on the plans. According to the executing agency, recent trend of growing diversification is viewed as a result of the above-mentioned education for farmers. The agency also explained that they need to continue gradual improvement through long-term initiatives hereafter since awareness-raising among farmers requires reasonable amount of time.

Table 5 Planted Area – Actual/Percentage of Planned Value(Rainy Season)[2]

(Unit: ha)

	Planned Value (2003)[3]	**At Ex-Post Evaluation (1998)[4]***	**2005**	**2006**	**2007**	**2008**	**% of Planned Value**
Rice	13,482	11,761	14,384	14,693	14,593	15,029	111%
Miscellaneous Grains	-	206	615	620	392	833	
Beans	786	39	172	63	74	-	0%
Peanuts	-	2	86	73	86	-	
Oilseed	-	69	95	112	144	50	
Vegetables	256	640	1,162	962	1,136	1,327	518%
Jute	-	-	-	-	-	-	
Potatoes	-	-	362	376	436	-	
Sugar Cane	-	-	515	492	530	152	
Wheat	-	-	-	-	-	-	
Total	**14,524**	**12,717**	**17,391**	**17,391**	**17,391**	**17,391**	**120%**

(Source) Department of Water Resources, Government of Orissa

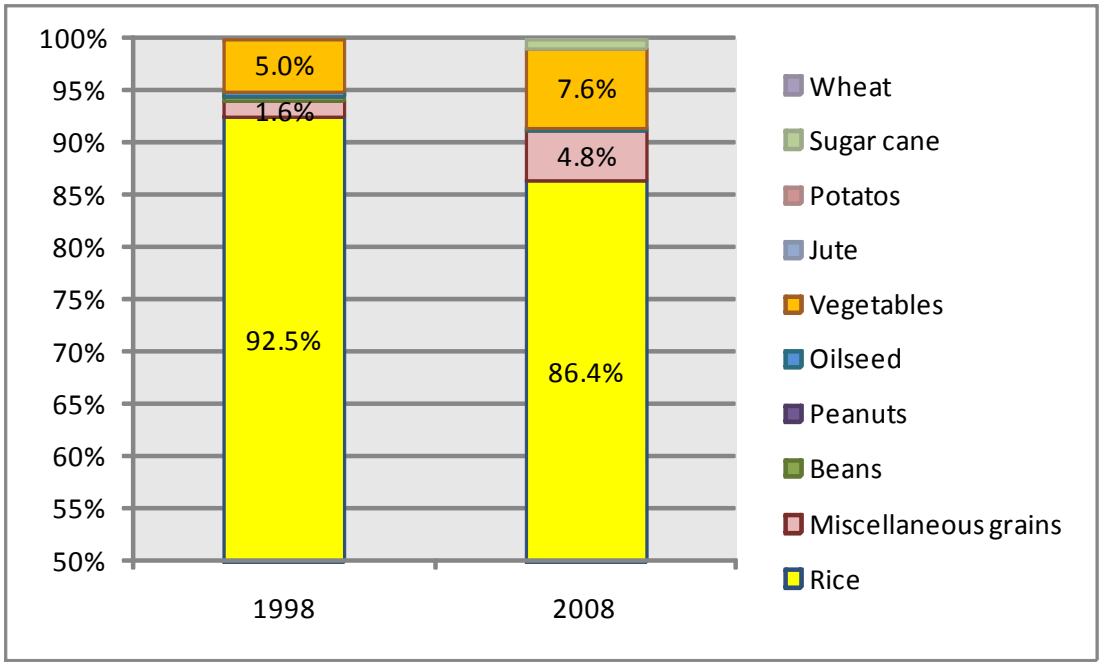
[2] The production schedule is decided by the Department of Water Resources. As the actual crops cultivation is decided by the farmers, the planned and actual values can vary greatly.

[3] As the planned year of the planted area is not noted on the ex-post evaluation report, 2003, which is the planned year of irrigated are, is assumed for the project year of this index.

[4] The ex-post evaluation was performed in 2003 but the evaluation is based on the results for 1998, the year of project completion.

Comparing the data of the 2008 rainy season to that of 1998 in Table 5, the structure that rice production comprises its majority has not changed. It seems that this trend in the fundamental structure will continue; however the production of such items as vegetables is gradually increasing. This can be interpreted as a result of the agricultural education detailed earlier and the diversification of production is expected to proceed further hereafter. According to the interview with WALMI, they believe that it is important to let farmers recognise the achievements and results of diversification and WALMI is carrying out initiatives such as establishment of a demonstration farm for high value sunflowers (for oil manufacturing).

Fig. 1 Composition of Products (Planted Area Base/Rainy Season)



(Source) Department of Water Resources, Government of Orissa

2. Dry Season

Particularly since the ex-post evaluation, production in the dry season has demonstrated remarkable growth, with the planned values generally achieved in the planted areas in the last few years. Similar to the situation in the rainy season, the breakdown in Figure 1 shows that rice comprises the majority of the production. Amongst the other items, production of vegetables is growing as a general trend, although 2008 saw a reduction due to seasonal effects.

Table 6 Planted Area – Actual/Percentage of Planned Value

(Unit: ha)

	Planned Value (2003)	At Ex-Post Evaluation (1998)	2005	2006	2007	2008	% of Planned Value
Rice	6,527	4,103	10,158	9,211	9,530	11,466	176%
Miscellaneous Grains	-	83	392	462	492	81	
Beans	1,746	410	282	382	305	-	0%
Peanuts	858	21	205	125	111	-	0%
Oilseed	-	52	177	117	127	-	
Vegetables	690	609	836	1,012	1,056	185	27%
Jute							
Potatoes	328	15	367	346	315	-	0%
Sugar Cane	-	16				-	
Wheat	1,470	3				17	1%
	11,619	**5,312**	**12,417**	**11,655**	**11,936**	**11,749**	**101%**

(Source) Department of Water Resources, Government of Orissa

Fig. 2 Rice Crop Zone of the Project Area

Fig. 3 Vegetable Cultivation in the Project Area

1) Yield

1. Rainy Season

The yield in the rainy season has not changed greatly since the ex-post evaluation, and the gross yield has remained stable at around the planned value. Production of vegetables in particular has been increasing, and has reached almost 25% of the total production base. It is reasonable to interpret that the effects of initiatives for the diversification of production detailed earlier are gradually realised.

Table 7 Agricultural Yield – Comparison of Planned Value and Actual Level

(Unit: 1,000 tons)

	Planned Value (2003)	At Ex-Post Evaluation (1998)	2005	2006	2007	2008	% of Planned Value
Rice	53.9	47.05	36.1	36.218	37.562	38.174	71%
Miscellaneous Grains	0	0.19	0.325	0.325	0.195	0.438	
Beans	0.7	0.01	1.579	0.622	0.73	0	0%
Peanuts	0	0	0.098	0.085	0.109	0	
Oilseed	0	0.21	0.022	0.029	0.039	0.013	
Vegetables	2.6	5.76	10.667	9.505	11.224	13.6	523%
Jute	0	0	0	0	0	0	
Potatoes	0	0	2.914	3.083	3.575	3.924	
Sugar Cane	0	0	0	0	0	0	
Wheat	0	0	0	0	0	0	
Total	**57.2**	**53.22**	**51.705**	**49.867**	**53.434**	**56.149**	**98%**

(Source) Department of Water Resources, Government of Orissa

2. Dry Season

Production output in the dry season has also improved since the ex-post evaluation, generally reaching planned values in the last few years. Although production output temporarily decreased in 2008 due to seasonal effects, the Department of Water Resources anticipates that it will recover usual level in 2009.

Table 8 Agricultural Yield – Comparison of Planned/Actual Level

(Unit: 1,000 tons)

	Planned Value (2003)	At Ex-Post Evaluation (1998)	2005	2006	2007	2008	% of Planned Value
Rice	26.1	18.47	28.47	24.09	25.50	30.96	118.6%
Miscellaneous Grains	0	0.17	1.37	1.70	2.48	0.42	
Beans	1.6	0.1	2.78	0.39	0.31	0.00	0.0%
Peanuts	1.4	0.33	0.33	0.20	0.18	0.00	0.0%
Oilseed	0	0.02	0.06	0.04	0.04	0.00	
Vegetables	6.9	6.09	8.26	10.37	10.82	0.20	2.9%
Jute	0	0	2.90	2.65	2.84	0.00	
Potatoes	3.3	0.01	0.00	0.00	0.00	0.00	
Sugar Cane	0	1.14	0.00	0.00	0.00	0.00	

Wheat	2.9	0.01	0.00	0.00	0.00	0.03	
Total	42.2	26.34	44.17	39.46	42.17	31.61	74.9%

(Source) Department of Water Resources, Government of Orissa

According to the focus group discussions with the Project's beneficiaries conducted during the field survey, they commented that drastic increases in annual yields were realized due to production of rice crop in dry seasons becoming possible though the usage of irrigation. This additional data also support an improvement in production conditions.

Table 9 Changes in Yield Based on Interviews with Beneficiaries

(Unit: tons/ha/year)

	Pre-Project	Post-Project
Minaguda village	0.6	1.9 -2.5
Jayantigiri village	0.6	2.0-2.5

(Source) interviews during the field survey

Fig. 4 Rice Harvest Operations

Fig. 5 Interview Survey with Beneficiaries

2.1.2 Impact

Questionnaire survey on beneficiaries was conducted to assess the impact of the Project. The survey targeted 150 households selected at random from the scheduled tribes and scheduled castes living within the Project area, and interview style questionnaire surveys and focus group discussions were conducted. The sample of 150 households was composed of scheduled tribes (77%), scheduled castes (15%) and others (8%). More than 90% of the sample was small farmers (Marginal owner farmers with agricultural land of around 0.5 - 1ha). Before the Project, their forms of employment were independent farming and secondary work as day labourers and migrant workers.

(1) Increase of Farmer Income

As shown by 2.1 Effectiveness, agricultural production has been improving since the period of ex-post evaluation and it can be said that this is contributing to improvement of the employment condition of the inhabitants in the beneficiary area. Data at the time of the ex-post evaluation did not take into account other income sources as it was a simple estimation based on the net income from agricultural production. However, this time, the beneficiary survey confirmed the occupation-wise / caste-wise average earnings before and after the Project and it gives the following results. The total amount of real income of all beneficiaries jumped up to 170%~maximum 370%. The particularly high rate of income increase among owner farmers is possibly because the effects from increasing the planted area and yield through progress in utilization of irrigation facilities. At the same time, the expansion of the agricultural land possessed by these farmers is also connected to increase in employment opportunities for day labourers. In fact, income of these farmers has risen to 170 - 230% of that before implementation.

Table 10 Changes in Average Income[5]

(Unit: rupee)

Class/Occupation	Day Labourer			Independent farmer		
	Pre-Project	Present	% of Pre-Project	Pre-Project	Present	% of Pre-Project
Scheduled Castes	7,167	16,063	224%	8,820	32,514	369%
Scheduled Tribes	8,319	19,362	233%	8,481	25,166	297%
Other Backward Classes	6,129	10,474	171%	9,607	27,040	281%
Average	**6,552**	**11,934**	**182%**	**9,706**	**27,400**	**282%**

(Source) Created by an external evaluator based on the beneficiary survey

In addition, approximately 82% of respondents confirmed improvement in their economic environment, and approximately 90% of them explained that it is due to improvement in agricultural production. In the interviews held with beneficiaries at the time of the field survey, many acknowledged the connection between increase in agricultural production and increase in household income. Therefore, it is possible that increase in household income of beneficiaries has been achieved as a consequence of the development of agricultural production since the ex-post evaluation.

(2) Employment Promotion and Settlement of Scheduled Castes and Scheduled Tribes

[5] The figures in the table are real incomes taking into account inflation and using 1998 as a standard. They differ from nominal income amounts.

(Minority Tribes)

The table below is a comparison of the annual number of days employed by different type of farmers. As mentioned in 2.1.2, the majority of sample beneficiaries were part-time farmers. Since project execution, the number of days that for migrant and day labourers employed has decreased whilst the number of days that owner farmers and other workers employed has drastically increased. This is probably because production has increased on the land of beneficiaries who used to be engaged in day labour and migrant work due to the Project, and the number of labour as independent farmer has increased.

Assessment of the direct attribution of the Project on farmer's income increase is difficult as the macro-economic condition of the Project area also influences these changes. However, the changes caused by the Project have probably made a certain contribution as shown by similar opinions in the beneficiary interviews conducted in the area.

Table 11 Annual Working Days by Labour Classification

	Before the Project	Present Time	Ratio
Day Labourers (Including Tenant Farmers	156	137	88%
Farmers (Owner farmer)	127	218	172%
Other (Storekeepers, Security, Rickshaw Drivers etc.)	219	417	190%
Migrant Workers	200	169	85%

(Source) Beneficiary Survey Results (Sample Number 150 Households)

(3) Improvement of Food Self-Sufficiency in the State

There has been no great change in food self-sufficiency since the ex-post evaluation and self-sufficiency for rice has been attained. The increase in agricultural productivity in the Project area during the dry season is probably making a certain contribution to securing stable food supply conditions.

However, supply of other items still depends upon import from other states. The main production in the Project area is rice, and due to geographical conditions, this structure will probably not change.

Table 12 Orissa State Food Consumption and Supply from Other States

(Unit: 1,000 tons)

	2006		
2006	Production	Consumption	Supply from Other States
Rice	6,928	5,905	-

Wheat	24	1,476	1,452
Sugar	226	500	274
Beans	17	150	133
Cooking Oil	600	2,008	1,408
Potatoes	79	1,476	1,397
Onions	260	736	476

(Source: Department of Water Resources, Government of Orissa)

(4) Impact on Environment

According to the Department of Water Resources, no particular problems have been reported. As soil-borne chloride has been confirmed in some parts of the Project area, the Agriculture Department is providing support for farmers through guidance on the usage method of chemical fertilisers.

It was confirmed that there was no significant damage due to chloride. However, a full-scale investigation concerning the chloride situation has not yet been implemented and questions still remain concerning the exact condition.

(5) Other Socio-Economic Impacts

According to the beneficiary survey about socio-economic changes given by the Project, 86% of respondents observed some kind of improvement. Among these opinions, those noting improvement in education of children and housing conditions were particularly common (60%). Upon determining the overall level of satisfaction about these effects after implementation of the Project, 65% responded with “satisfied” and 23% with “reasonably satisfied”, indicating a certain level of satisfaction has been achieved.

Other than the direct benefit from agricultural production, positive opinions about benefit of irrigation facilities were confirmed in the beneficiary interview, such as convenience of transportation due to access roads constructed by the Project and usage of the irrigation canal water for domestic purposes.

From the above results, the improvement of agricultural production has clearly brought about improvement in the income and living environment of the beneficiaries. The situation has been greatly improved since the ex-post evaluation, and the impact initially expected is coming into effect. These impacts will be reinforced with optimum usage of the irrigation facilities through developing on-farm infrastructures and technical assistance.

2.2 Sustainability

2.2.1 Operation and Maintenance

2.2.1.1 Structural aspect of Operation and Maintenance

There has been no great change concerning the fundamental roles and structure of operation and maintenance since the ex-post evaluation. The Department of Water Resources administers dams, the main canal, and also distributary branch canals until establishment of irrigation associations, and the irrigation associations administer the tertiary canals. After establishment of irrigation associations, the operation and maintenance of secondary canals downwards are transferred to the association. However, in practice there found cases which transfer of operation and maintenance duties to the associations has not been completed and the Department of Water Resources still conduct operation and maintenance works.

1) Department of Water Resources (UKIP Office)

No great changes in organisation and functions since the ex-post evaluation are confirmed. Currently the Department of Water Resources includes 145 full-time staff members and a total of 679 when temporary workers are counted. UKIP office commented that the current structure and scale of the office is adequate to maintain the service standard.

2) Irrigation Associations

Definite improvement has been seen in registration and transfer of authority to irrigation associations, which was raised as a recommendation in the ex-post evaluation. The current status of registration is as follows. Within the total of 97 in the Project area, transfer of authority has been completed for 35 and registration has been completed for 56, meaning registration has been completed for approximately 90% in total. However, even for the case that the authority has been transferred to associations, it was pointed out that the Department of Water Resource occasionally conducts operation and maintenance of secondary canals due to lack of actual activities by the associations..

Table 13 Formation of Irrigation Associations in the UKIP Jurisdiction

	2006	2007	2008	2009
Authority Transfer Complete	6	6	27	**35**
Registration Complete	19	55	57	**56**
Registration in Progress	36	36	13	**6**
Unregistered	36	0	0	**0**
Total	97	97	97	**97**

(Source) Department of Water Resources, Government of Orissa

As a measure for activation of irrigation associations, officials from the Department of

Water Resources periodically visit and hold meetings to motivate farmers to join associations' activities. According to the Department of Water Resources, definite improvement in farmer awareness has been seen compared to the time of the ex-post evaluation. One possible reason could be that agricultural production is developing favourably and the benefit of the irrigation facilities is materializing in a visible form. However, some people still believe that the Department of Water Resources should be responsible for maintenance and operations of the irrigation facilities. Thus, irrigation associations will probably require more time until their activities become stable.

2.2.1.2 Technical aspects of Operation and Maintenance

1) Department of Water Resources (UKIP Office)

Currently the Department of Water Resources can manage by themselves since the technical level required for the basic operation and maintenance works such as canal cleaning and repairing works is not particularly high. In addition, the Department, under collaboration with WALMI and other organisations, carry out technical assistance and development of production environment necessary for optimisation of the irrigation facilities. The awareness-raising of local farmers depending on traditional methods is rather difficult and accumulation of good practices will be necessary.

2) Irrigation Associations

The irrigation associations basically have responsibility for operation and maintenance of secondary canals and below. These works is not especially difficult in terms of technical level, and periodical visits are carried out by UKIP staff. Therefore it is fair to say no particular problem exists.

However, there are now few cases where the irrigation associations systematically engage in operation and maintenance activities. In practice, individual beneficiaries are voluntarily cleaning canal at the points connected to their own agricultural land.

2.2.1.3 Financial aspects of Operation and Maintenance

1) Department of Water Resources (UKIP Office)

Costs of operation and maintenance in the UKIP office for the past three years are as follows. It marks increase of 1.5 times from the time of the ex-post evaluation, even taking into account inflation. Just over 60% of this constitutes labour costs and ordinary expenses for the operation and management department, with the rest appropriated for physical works of operation and maintenance.

Table 14 UKIP Office Annual Budget and Expenditures

(Unit: million rupees)

	Before Ex-Post Evaluation				
	2001	2002	2006-07	2007-08	2008-09
Budget	15.3	13.7	17.93	17.49	32.04
Expenditures	9.7	9.7	16.14	16.46	27.10

(Source) Department of Water Resources, Government of Orissa

The UKIP office pointed out a problem of delays in budget contributions from the state government along with budget deficiency. For this reason, actual expenditure is less than the initial budget. The current operation and maintenance budget per hectare is approximately 520 rupees. Although it improved from the 450 rupees at the time of the ex-post evaluation, approximately 800 rupees is estimated as necessary for appropriate operation and maintenance. There is a request-based budget in addition to the annual budget for cases such as emergency support required for damage to the canals etc. However, UKIP office insists that the current budget is insufficient and the necessity of proper allocation and execution of the budget.

Furthermore, the ex-post evaluation reported that funds from the Indian government and the sale of water for private sector may be available to compensate the insufficiency of the budget. However, neither of these initiatives has materialised so far.

2) Irrigation Associations

No changes were confirmed in terms of payment structure for operation and maintenance costs from the time of the ex-post evaluation. The irrigation associations receive an annual maximum of 100 rupees/ha from the Department of Water Resources as operation and maintenance expenses, which forms the main resource for the irrigation associations.[6] The collection rate of irrigation expenses for the last few years is fluctuating around 50% as shown in the table below, falling from a mid-60% at the time of the ex-post evaluation. The following reasons are considered.

1. Weak link between collection of the irrigation fees and the actual operation and maintenance budget

[6] However, it is necessary to maintain at least 75% participation in order to receive this operation and maintenance expense, which is forfeit if participation falls below this level. The irrigation expense borne by the farmer does not directly become the revenue of the Department of Water Resources as it is paid directly to the state government through the State Department of Revenue.

(At the time of the ex-post evaluation, collected irrigation fees were sent to the state Department of Revenue. The structure which the paid fees are not directly used as revenue for the Department and beneficiaries is maintained.

2. The beneficiaries believe that the irrigation facilities are provided by the state and perception of burden/cost sharing has not yet spread among them.
3. There are variations in operation and maintenance conditions in accordance with the increase in the number of irrigation associations (38→97)

Table 15 Collection of Irrigation Costs

(Unit: million rupees)

	1997	1998	1999	2006	2007	2008
Appraisal Amount	1.35	5.14	6.31	7.4	7.57	7.54
Collected Amount	0.91	2.94	4.16	3.4	4.23	4.14
Collection Rate	67%	57%	66%	46%	56%	55%

(Source) Department of Water Resources, Government of Orissa

The Department of Water Resources seeks farmers' understanding concerning the collection of irrigation fees thruogh the staff guidance visits. However, it is not realistic to expect that the collection rate will improve in the short term since reasonable amount of time is required to change the farmers' perception that operation and maintenance of the irrigation facilities is responsibility of the government.

2.2.2 Current status of Operation and Maintenance

The present conditions of the main canals and the main sections of secondary canals are as follows. At present there are no serious problems which may damage the core functionality of irrigation facilities. However, conditions will possibly deteriorate hereafter if small damages are neglected.

Table 16 Status of Principal Irrigation Facilities

Target	Status	Operation and Maintenance Authority	Details
Main Canal	Sections damaged	Department of Water Resources, Government of Orissa	50-80cm silt could be seen. In addition, damage cased by rain in parts of embankment could be seen.

Secondary canal	Sections damaged	Irrigation Associations. However there are many cases where the Department of Water Resources, Government of Orissa is actually managing	As above
Tail-Ends of Canals	Problems	Irrigation Associations	There is silt and progression of embankment damage in many of the canals. Maintenance is necessary

Fig. 6 Damaged Canal

Fig. 6 Damaged Canal

The Department of Water Resources is currently preparing an action plan for maintenance work of these damaged points to submit the state government. In the discussions with the Department, it was confirmed that the plan have already been partially approved and is at the stage of acquiring budgetary provision. By these efforts, at the very least, problems which may damage the basic functionality of the irrigation facilities are probably not impending.

3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

The status of agricultural production generally satisfies the initial plan and shows drastic improvement from the time of the ex-post evaluation. Meanwhile problems such as budget deficiency for repair of the facilities and operation and maintenance, and activation of irrigation associations still remain and need to improve.

3.2 Lessons Learned

It took a certain length of time after completion of the Project until the outcome revealed. As nature of the irrigation project, certain time will be required until the optimal status of utilization realized. This is because it requires education of beneficiaries on irrigation system and associations. Had the support for these soft approach been incorporated into the Project scope from the original plan, the outcome of the Project might have been achieved earlier.

3.3 Recommendations for the Executing Agency

1) Concerning the physical damages of the irrigation facilities, financial support from the state government is planned. However, the maintenance budget may be delayed or insufficient. Adjustments at the state government may be necessary to avoid delay or deficiency in budget distribution.

2) The promotion of dry field farming is one possible option to improve the allocation rate of irrigation water. Upon promoting diversification hereafter, it will be necessary to change the mindset of farmers who rely on traditional rice crops. Long-term initiatives will probably be necessary, such as the development of pilot farms by WALMI and raising awareness through increasing successful precedents.

3) Current system of budget allocation, which guarantees stable supply of budget, is presumably appropriate considering the various operational status of irrigation associations and low collection rate of water charge. However, to promote the transfer of authority to irrigation associations in the future, building a system that irrigation associations directly collect and manage irrigation fees for their operation and maintenance activities can be one option to enhance their ownership.

4) Although there is no water shortage now, it may be necessary to adopt a mechanism to

strengthen coordination between the Department of Water Resources and the state electric power corporation as a crisis management measure for risk of future water shortage.

Item	Planned	Actual
① Output		
1. Engineering Works		
(1) Irrigation Land Area	21,000 ha	15,208 ha
(Jeypore main canal)	(14 km point - 41.78 km point)	(as planned)
(2) Secondary Canal	RD 28.08 km point	As planned
	RD 33.75 km point	As planned
	RD 35.50 km point	As planned
	RD 41.78 km point	As planned
(3) Supply Waterways, Drain	14.00 km point - 41.78 km point	As planned
2. Material and Supplies Procurement	Construction materials, etc.	As planned
② Project Period		
Engineering Works		April 1989-June 1998
1) Main Canal and Secondary Canal	April 1989-March 1993	
2) Water Course Field Channel	April 1989-March 1993	April 1989-June 1998
3) Drainage Waterway	April 1989-March 1993	April 1989-May 1998
4) Materials and Supplies Procurement	April 1989-March 1993	April 1989-May 1997
5) Land Acquisition	April 1988-March 1992	April 1988-July 1998
③ Project Cost		
Foreign Currency	795 million yen	unknown
Local Currency	6.742 billion	unknown
	(688 million rupees)	(1,050 million rupees)
Total	7,537 million yen	3,786 million yen
ODA Loan Portion	3,769 million yen	3,114 million yen
Exchange Rate	1 rupee ＝ 9.8 yen	1 rupee ＝ 4.06 yen