Indonesia

Pamarayan – Ciujung Irrigation System Rehabilitation Project

Report Date: March 2001
Field Survey: August 2000

1. Project Profile and Japan's ODA Loan

Location Map of Project Area

Overall View of Pamarayan Headwork

(1) Background

The Ciujung irrigation facilities are situated on the bank of the Ciujung River in the {Banten} area of Western Java. They draw water from the Ciujung River and deliver it as irrigation water to 24,200ha of paddy fields through the Pamarayan headworks and irrigation canals. The former Pamarayan headworks consisted of sluice gates built in 1918, making them approximately 70 years old at the time of the appraisal. The structure itself was in a stable condition, but scouring had been observed in the lower river bed, and there was concern over the possibility of collapse in the event of flooding. The question of whether to deal with the problem by rehabilitation or reconstruction was subjected to a comprehensive study of the technical and cost issues, leading to the conclusion that reconstruction should be chosen due to the anticipated lifespan of the existing structure. In addition, the water siphoning effect of the irrigation canals had declined and their surfaces were crumbling. In particular, the intense rain which hit the Northern {Banten} area in 1981 caused severe damage.

The refurbishment of the facilities (headworks and water canals) has been worked on since 1971 by the World Bank. Nevertheless, the long-term, effective maintenance of the facilities required radical measures, centering on reconstruction of the headworks.

(2) Objectives

This project was to rehabilitate the irrigation facilities, including reconstruction (new construction) of the headworks, to ensure stable and sustained supply of irrigation water to the Ciujung irrigation area (24,200ha).

(3) Project Scope

The scope of the project is as follows.

i) Reconstruction of the Pamarayan headworks and improvement of related facilities
   - Construction of the headworks
   - Rehabilitation of maintenance access roads

ii) Purchase of maintenance equipment

iii) Consulting services

- The detailed design and construction supervision required 686.5m/m of consulting service.

Figure 1 Summary Map of This Project (non-scaled)

(4) Borrower/Executing Agency

Republic of Indonesia / Directorate General of Water Resources Development, Ministry of Housing and Infrastructure Development (Former Directorate General of Water Resources Development, Ministry of Public Works)

(5) Outline of Loan Agreement

Loan Amount/Loan Disbursed Amount	¥5,667 million / ¥5,662 million
Exchange of Notes/Loan Agreement	October 1988 / October 1988
Terms and Conditions	Interest rate: 2.7%, Repayment period: 30 years (10 years for grace period), General Untied (Partially untied for consulting services)
Final Disbursement Date	March 1997

2. Results and Evaluation

(1) Relevance

The irrigation facilities covered by this project were in use, supplying irrigation water to an area of over 20,000ha. The facilities were becoming increasingly dilapidated, which degraded performance and raised concern over the possible collapse of the headworks. The refurbishment carried out by this project was urgent, and the plan was relevant. The implementation of the project included alterations to the construction methods used for lateral water canals, and refurbishment works were added for some trunk and branch canals, but these were appropriate measures for the attainment of the project's objectives.

(2) Efficiency

The executing agency for this project was Directorate General of Water Resources Development, Ministry of Housing and Infrastructure Development (formerly Directorate General of Water Resources Development, Ministry of Public Works). The works were carried out by the Pamarayan Project Office, an organization under the Water Resources Office. Project costs were kept within planned values, for both local and foreign currency. The completion of the construction works was four years behind the planned implementation schedule. The reasons for the delay, according to information obtained from the executing agency, were the additions and alterations to the plans, particularly for the lateral water canals, due to topography and geological conditions, as well as performance problems with works management and quality control by contractors.

(3) Effectiveness

1) Quantitative effects

As this project was to rehabilitate irrigation facilities, concentrating on the existing headworks, there was no substantial change in efficacy indicators between before and after the project. Nevertheless, the project was able to sustain the stable supply of water for agriculture.

i) Stability of cultivated area

Table 1 shows recorded values of cultivated land area for the rainy and dry seasons in the project area. The figures remain stable from before to after the completion of the project, suggesting that this project helped to stabilize farming activity in the project region.

Table 1 Recorded Figures for Cultivated Area

Indicator		1994	1995	1996	1997 Year of completion	1998	1999
Cultivation records (rice)[1] (ha)	Rainy season	21,321	21,454	21,454	21,454	21,402	21,321
	Dry season	16,241	13,452	14,531	11,522	12,840	15,465
	Total	37,562	34,906	35,985	32,976	34,242	36,786

Source: Serang and {Tangeran} Irrigation Project Office

[1] Cultivation records are as reported by the project executing agency.

ii) Productivity and agricultural income

Table 2 shows recorded unit yields (tons/ha) and annual production (tons/year) for rice, which is the main crop in the area. Unit yield dropped to 2.5tons/ha in the rainy season of 1998 (drought caused the dry season to extend for longer than usual), but in other years the yields are largely in the 5.0~6.0tons/ha range.

Annual production volume was unusually low in 1998, but has otherwise stayed within plus or minus 10% of 200,000 tons/year. The drop in annual production and unit yield values between 1997 and 1998 was due to the impact of the El Nino phenomenon, which caused an extraordinarily long drought. The cropping pattern planned at the time of the appraisal for land in the irrigated area was rice – rice, or rice – rice – mixed grains. The dominant pattern now is two crops of rice.

Table 2 Recorded Figures for Unit Yield and Production Volume of Rice

Indicator		1995	1996	1997 Year of completion	1998	1999
Rice harvest per unit area[2]	Rainy season	6.0	6.0	6.5	2.5	5.0
(tons/ha)	Dry season	6.0	6.5	2.5	2.5	5.0
Rice production[3]	Rainy season	128,724	128,724	139,451	53,505	106,605
(tons)	Dry season	80,710	94,452	28,805	32,120	77,325
	Total	209,434	223,176	168,256	85,605	183,930

Source: Serang and {Tangeran} Irrigation Project Office

2) Evaluation by local residents

This study included a questionnaire survey of 100 farming households in the project area, which was conducted with the assistance of the local government's irrigation project office[4]. ("N" in the graphs refers to the number of questionnaires collected.) The farmers surveyed did not necessarily answer on the basis of a sound understanding of project effects, but the survey was conducted as a way of incorporating the voices of the farmers. The average land area per farmer was about 1~1.5ha, with the main cropping pattern being two crops of rice. Approximately nine out of ten farmers had been farming their land for ten years or more. The questionnaire asked questions concerning the following areas:

[1] Evaluation and current state of the irrigation facilities as a whole.
[2] The state of payment of water use charges.
[3] Changes in productivity.
[4] Participation in operation and maintenance activities.
[5] Satisfaction with the irrigation project as a whole, and further opinions and wishes.

Responses to [1], [3] and [5], which deal with project effects, will be discussed here. [2] and [4] will be discussed in Section 5 "Sustainability". The comments made should be regarded as applying to irrigation facilities in general, rather than being limited to this project alone.

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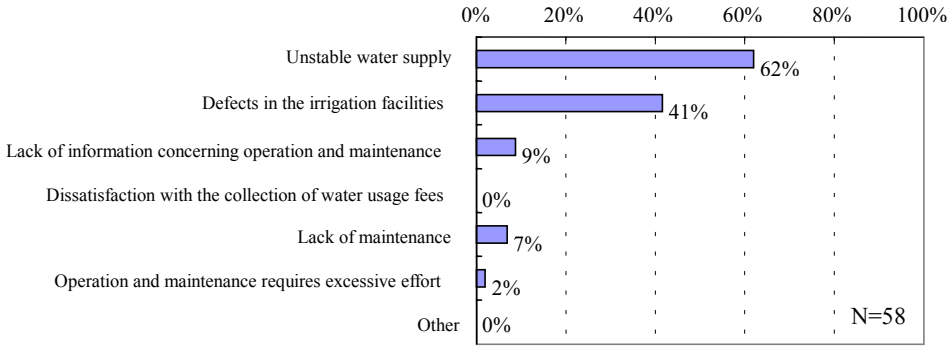
2 Records for rice yields per unit area are as reported by the project executing agency.
3 Records for rice production volume are as reported by the project executing agency.
4 The 100 households are a random sample from six areas in the upper, middle and lower reaches of the river, selected on the basis of information from the executing agency. The questionnaires were conducted in the form of face to face question and answer sessions.

<Evaluation and current state of the irrigation facilities as a whole>

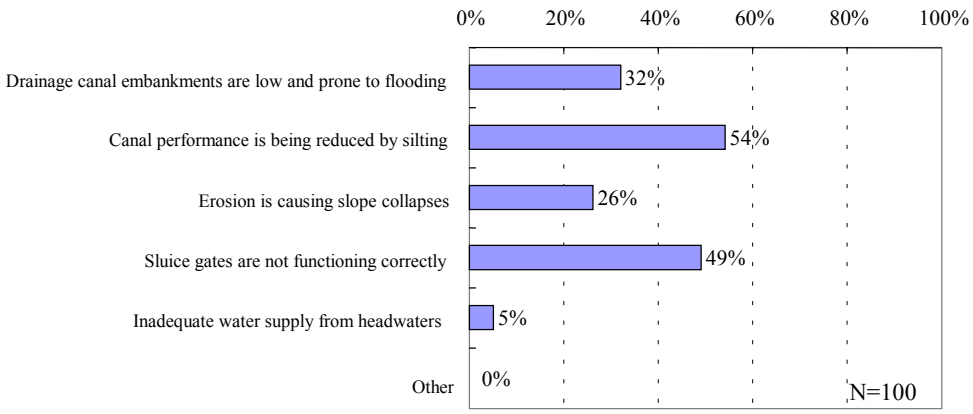
After the project was completed, it was transferred to the jurisdiction of the local government, which maintains the facilities. However, approximately 60% of the farmers expressed dissatisfaction with the current water management system. The main reasons were "unstable water supply (60%)" and "defects in the irrigation facilities (40%)" (Figure 2). The first problem appears to be due to the influence of human action, in the form of improper water usage, rather than to any instability in the water supply capacity of the irrigation facilities. The second complaint, of "defects in the irrigation facilities", was confirmed to refer to problems of the irrigation system as a whole, mainly in the tertiary canals surrounding the fields, which are outside the scope of the ODA loan project. (The same is true of other problems with facilities mentioned below).

Figure 2 Reasons for Dissatisfaction with the Current System of Water Management by the Local Government (multiple responses permitted)



On the current overall state of the irrigation facilities, approximately 70% stated that it was "good" or "adequate", but around half of the households indicated problems such as "declining canal function due to silting" and "malfunctioning sluices" (Figure 3). These comments reflect the poor state of maintenance of the water canals overall.

Figure 3 Perception of Problems with the Current Irrigation Facilities (multiple responses permitted)



As mentioned above, this project maintained the stable supply of water for agriculture, but human behavior such as “frequent improper use of water (76%)” causes nearly 70% of respondents to perceive a problem in water supply. This result illustrates the difficulty of proper water management by local governments and water cooperatives.

<Changes in productivity>

This project was not implemented to produce a direct effect in increasing production, but it did actually yield increases. Rainy season production rose from 4.9 tons/ha to 5.5 tons/ha, a 12% increase, while dry season production rose by 15% from 4.6 to 5.3 tons/ha. These are average figures based on responses to questions on how rice productivity had changed, calculated from valid responses.

<Satisfaction with the irrigation project as a whole, and further opinions and wishes>

Survey subjects were asked to rate their satisfaction with the irrigation project as a whole in four grades. The satisfied respondents, who said that they were either “very satisfied” or “satisfied”, accounted for 54%, while the dissatisfied, who responded that they were “somewhat dissatisfied” or “dissatisfied” formed a 46% share. The farmers are likely to have answered without having a grasp of the project plan, complaining of “defects in irrigation facilities” that were outside the scope of the project, but the results should be accepted as the frank responses of local farmers.

(4) Impact

1) Impact on environment

In the questionnaire survey described above, survey subjects were asked whether this project had produced any undesirable impact on the area. Of the 100 households, 97 responded that there had been no such impact. The other three complained of impact on landslides, erosion and river silting, but did not indicate any direct impact on the environment. The local government has not reported any notable negative impact on the environment.

2) Impact on society

The questionnaire survey of beneficiaries conducted for this study asked them about the impact of this project on the area. Over 80% of farmers said that they had noted the project’s positive impact in stimulating the regional economy. Nearly 90% said that their agricultural income had increased. These results indicate that the project has achieved some degree of success in its qualitative aim of “protecting the severely dilapidated Pamarayan headworks from the risk of collapse, and providing a continuing supply of water to the Ciujung irrigation area, which is the beneficiary area, in order to prevent disasters and stabilize agricultural income”.

(5) Sustainability

1) Operations and maintenance

After the completion of the new headworks which were built under this project, they were transferred to

the local government as planned. The headworks and canals are now maintained by the irrigation project office (with 147 staff) which operates under the districts of Serang and {Tangeran}. The tertiary canals and smaller terminal waterways around the fields are to be maintained by the water users' cooperatives (198 cooperatives in all) which were established for each irrigation block. However, the project office says they do not adequately understand or cooperate with the work of the cooperatives or the collection of water usage charges, and the cooperatives are not functioning as planned.

2) Operations and maintenance status

i) The headworks, trunk and branch canals

The budget for maintenance of the headworks and the trunk and branch canals is allocated by the state government on receipt of request from the Serang – {Tangeran} irrigation project office. Table 3 shows the state of the maintenance budget (not including personnel costs). After completion of the project the allocation was to be doubled from the previous level, to 40 million Rupiah/year. However, the project office says that the amounts it requests are usually not paid in full, and it only receives around one third of the allocation it considers necessary.

Table 3 Maintenance Budget Provided for the Headworks and the Trunk and Branch Canals

	Before project implementation 1991-1996	After project completion 1997-2000
a) Amount required annually (millions of Rupiah/year)	70	120
b) Actual budget allocation (millions of Rupiah/year)	20	40
c) Budget coverage rate (%)	28.6%	33.3%

Source: Serang and {Tangeran} Irrigation Project Office

Despite this kind of budget restriction, the headworks built under this project have functioned without significant problems since completion six years earlier (1994). The trunk canals (including main water canals) and branch canals built under the project are maintained relatively well, and the facilities are in generally good condition. However, day to day maintenance is one factor affecting the lifespan of the facilities, and expenditure on maintenance should be expanded in future.

ii) Terminal field facilities

The maintenance costs for tertiary and smaller terminal waterways around fields are to be covered by the water usage charges collected by water users' cooperatives. The charges are set by the local government and are collected from individual farmers (cooperative members) by the cooperatives. The cooperatives use the collected charges as the source of funds for maintenance work they perform on the terminal field facilities.

According to the Serang – {Tangeran} Irrigation Project Office, the level of charges appears to be set at a level which can be reasonably borne by the farmers, judging by the current levels of harvests and revenues[5]. In the project area, 198 cooperatives have already been established, and the 315 terminal distribution zones

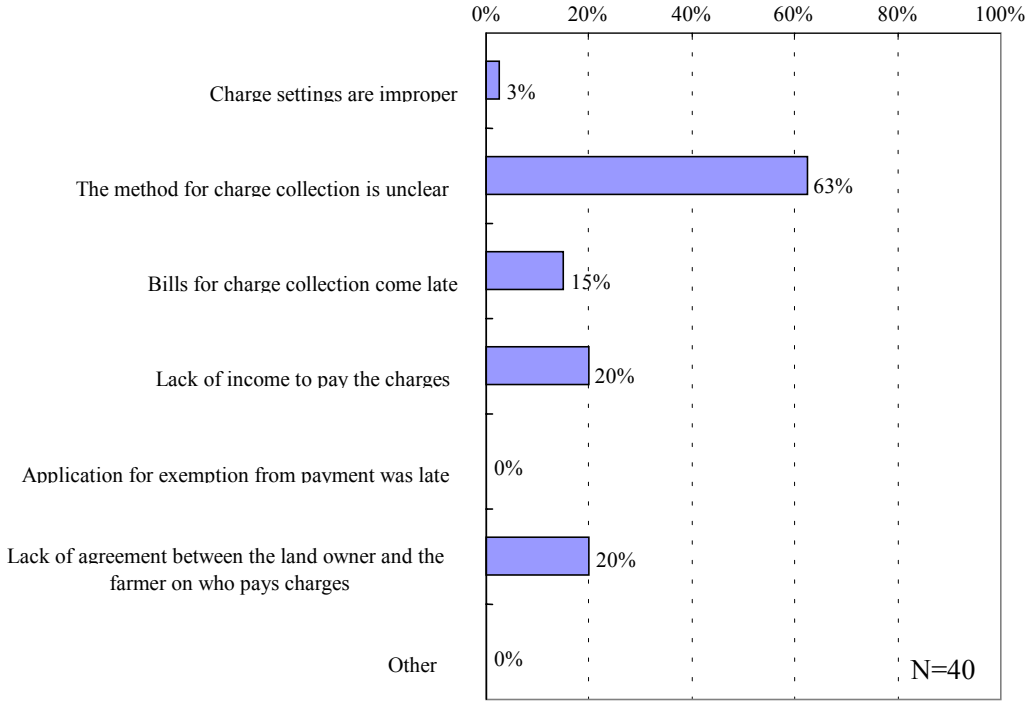
[5] If the unit rice yield is 5.0tons/ha and the price is 1,000 Rupiah/kg, the gross income per harvest would be 5 million Rupiah/ha. In comparison, the water usage charges are set at 14,000 Rupiah/ha, less than 1% of the calculated gross income.

are divided between them. The local government audits the water usage charge collection situation and the state of maintenance of the facilities in each cooperative annually, and sorts them into “active” and “inactive” categories. In FY 2000 there were 106 cooperatives deemed active and 92 deemed inactive, meaning nearly half of the cooperatives leave room for improvement in their collection of water usage charges and maintenance of facilities. Under this situation, the value of collected charges is only around 34% of the target value (in 1999).

When survey subjects in the questionnaire carried out for this study were asked about their recent payment of water usage charges, less than 40% responded that they “pay all of their charges”, while 60% leave some or all of their charges unpaid.

The most prominent reason for non-payment was that “the method for charge collection is unclear”. Other reasons included “lack of income to pay the charges” and “lack of agreement between the land owner and the farmer on who pays charges”, but these reasons were not common. (Figure 4).

Figure 4 Reasons for Non-payment of Water Usage Charges (multiple responses permitted)



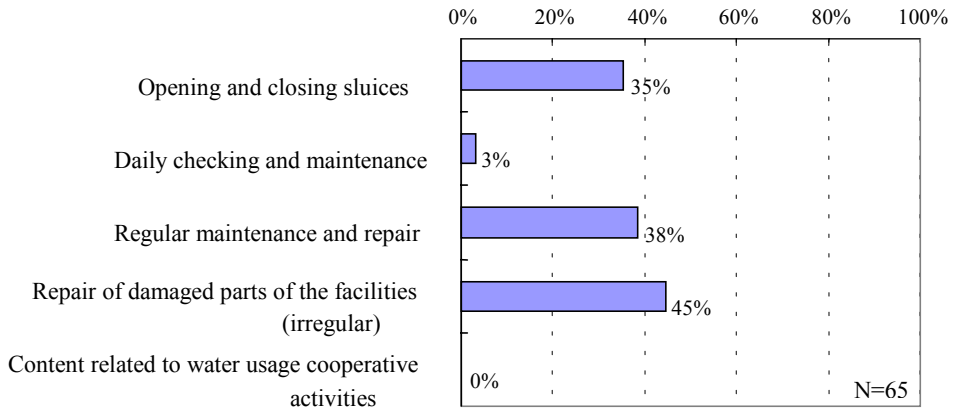
In the same questionnaire survey, 65% of farmers responded that they were actively involved in the operation and maintenance of the irrigation facilities. Besides being cooperative members, most of those farmers were engaged in the work of the cooperative for reasons of personal interest or position. The specific content of their work included “repair of damaged parts of the facilities”, “regular maintenance and repair” and “opening and closing sluices”. (Figure 5)

The executing agency says that the main reasons why farmers do not pay water usage charges are that they do not adequately understand the charges, or that they do not receive enough water. The executing agency is countering this situation through the following measures:

- Thorough explanation to the farmers of the framework for maintenance of the facilities, including water usage charges.

- Shifting management of the water usage costs from the local government to the cooperatives themselves.
- Allowing themselves to be used in the maintenance of the tertiary canals.
- Guidance to the cooperatives in how to distribute water through the tertiary canals.

Figure 5 Content of Operation and Maintenance Work by Questionnaire Respondent Farmers (multiple responses permitted)



The above findings show that no system has been established for organized activity in line with the water users' cooperative method to run the terminal field facilities in the project area, and therefore maintenance work is inadequate. At the sites visited in the field survey, there was obvious silting in the canals and uncontrolled weeds around them, which is cause for concern over declining flow capacity. The farmers appeared to be carrying out some independent maintenance work, but their work did not extend beyond the surroundings of their own farms.

3) Sustainability of effects

This project was to prevent damage being caused by the collapse of the old headworks, and repair some of the trunk and branch canals, with the aim of providing a continued and stable supply of water for farming. After the completion of the project, its efficacy in preventing damage from the collapse of the old headworks was reflected in the stability of agricultural production activity in the area. The trunk and branch canals are in relatively good condition, and no notable problems were observed at the time of evaluation. However, with a view to the future sustainability of the project, the maintenance of the facilities needs to be supported by an appropriate and sustainable level of burden on the farmers and of budget allocation from the local government.

According to the maintenance agency, the irrigation area enjoyed the benefits of irrigation for decades before the implementation of this project, and there is little custom or motivation among farmers to pay charges for their water usage. According to the questionnaire survey, many farmers responded that they don't pay because "the method for charge collection is unclear", which suggests that farmers do not have a clear understanding of the rules for water usage charges and their collection. Where that is the case, thorough education and publicity regarding the systems and methods concerned is required.

Comparison of Original and Actual Scope

Item	Plan	Actual
①Project Scope		
1. Rehabilitation works		
(1) Headwaters	Ciujing River	Same as left
(2) Target irrigation area	24,200ha	21,454ha
- Left bank area	18,600ha	16,907ha
- Right bank area	5,600ha	4,547ha
(3) Headwork	Concrete pile basis, compatible for 100-year probable flooding	Same as left
(4) Intake etc.	Roller gate type	Same as left
(5) Trunk liaison canal	Concrete finish	Same as left
(6) Control building	RC structure ($270m^2$)	Same as left
(7) Maintenance road	6m road width, approx. 27km extension	Same as left
(8) River crossing canal	堤水式	Steel pipe type
(9) Appurtenant work of new headworks	—	Steel plate pile concrete bed
(10) Rehabilitation of irrigation network	Basic system design	Basic design, detailed design and partial rehabilitation of trunk and branch canals
2. Consulting Service		
(1) Detailed design	230.5 M/M	230.3 M/M
(2) Construction supervision	456.0 M/M	1,029.4 M/M
②Implementation Schedule		
1. Selection of consultant	Oct. 1988 ~ Feb. 1989	Oct. 1988 ~ Nov. 1989
2. Consulting service	Nov. 1989 ~ Oct. 1994	Nov. 1989 ~ Jul. 1997
3. Selection of contractor	Jan. 1990 ~ Mar. 1991	Nov. 1991 ~ Jan. 1992
4. Improvement of maintenance road	Jul. 1990 ~ Mar. 1991	Dec. 1990 ~ Nov. 1992
5. Construction of Pamarayan Headwork	Apr. 1991 ~ Oct. 1993	Feb. 1992 ~ May 1997
6. Procurement of maintenance equipment	Mar. 1993 ~ Oct. 1993 ※To be completed in October 1993	Mar. 1993 ~ Jul. 1997 ※Completed in July 1997
③Project Cost		
Foreign currency	¥4,207 million	¥4,234 million
Local currency	¥1,733 million	¥1,706 million
Total	¥5,940 million	¥5,940 million
ODA loan portion	¥5,667 million	¥ 5,662 million
Exchange rate	1Rp.＝¥0.0883 (Jul. 87)	1Rp. ＝¥0.0520 (Mar. 97)