ANALYSIS OF REHABILITATION PRIORITY OF IRRIGATION INFRASTRUCTURE

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ABSTRACT

The decreasing service function of the technical irrigation system should be supported by routine and periodical maintenance and rehabilitation which needs human resource and costs. Since limited resource is a problem to the government, an analysis of rehabilitation priority is required for 9 irrigation area in Kabupaten Purworejo. Rehabilitation priority analysis to the technical irrigation system taken in this study was carried out by assessing the irrigation water service function, water availability, and functional area. The service function assessment was based on the totally disturbed criteria, semi disturbed criteria, or not disturbed criteria. Results of the analysis showed that the first priority was for increasing the irrigation system status from semi technical to technical irrigation. The first priority was Tegalduren (small and semi technical irrigation) and the last was Krasak (small and technical irrigation). The next priority was large, medium and average irrigation system. Such condition implied that rehabilitation for small (technical) irrigation area was organized by the farmers themselves.

Keywords: *technical irrigation system, service function, water availability*

INTRODUCTION

In general, irrigation network system in Indonesia, especially in Java, is inherited from Dutch Colonial period. During the period, the system was meant to fulfill water demand for sugar cane cultivated area. This can be indicated by many sugar plant estates remained, some of them are still operating until now (Nurdiyanto, 1994). The purpose of the sugar plants was to utilize the plentiful water resources, land and human resources in Java. This made Indonesia to become the largest sugar exporter after Cuba in the early 20th Century (Sastrodihardjo, 1996).

Water resources (river water) was taken by weirs and flown to paddy fields using technical irrigation network. Up to now, the colonially technical irrigation network systems are about a century old with many of them being well functioned. It proves that the infrastructure operation is in accordance to the procedures. However, routine and periodical maintenance is necessary. It is also proved that rehabilitation without financing obstacle has guaranteed the continuing service function of the irrigation system. The system has been through part or even total rehabilitation in 80's and 90's. The technical irrigation networks in Kabupaten Purworejo (most of them were Dutch Colonial heritages) are utilized for irrigating paddy and palawija fields. Some of the command areas, covering less than 1000 ha, are currently under the management of Dinas Pengairan Kabupaten Purworejo. In the autonomy era, a problem to be coped with is that maintenance and rehabilitation costs have not been achieved the needs to have continuing function of the irrigation network system. A study on the operational and maintenance condition is required to identify the performance of the irrigation network system in order to be used for composing the rehabilitation program.

RESEARCH METHOD

Research Location

This research was taken on Dinas Pengairan Kabupaten Purworejo service area. Nine selected command areas were spread evenly in Kabupaten Purworejo, as presented in Figure 1.

The selection was based on the area of the service irrigation network, starting from the smallest (30 ha) to the largest (993 ha). Detailed names, areas, and classifications of each command areas are presented in Table 1.

Data Collecting

Primary data for analysing the damage of irrigation infrastucture (weir, channel, division structure, embankment and inspection road, discharge measurement structure) was collected by survey and investigation included interviewing the managements. Secondary data such as area, water availibility were collected from Water Resources Service (Dinas Pengairan) and Unit Pelaksana Teknis Dinas Pengairan (UPTD) Kabupaten Purworejo. All of the data will be used for analysing the rehabilitation priority of 9 commands area in

Kabupaten Purworejo based on the total score of the irrigation infrastructure damage, water availibilty in a year and command area.

Method of Rapid Appraisal

Rehabilitation priority can be carried out by performing rapid appraisal to several factors. Ministry of Public Works (Ministry of Public Works, 2006) has issued regulations related to the rehabilitation programs, based on the infrastructures condition, water availability, irrigation area, increasing crop intensity, increasing production and proposed expenditure.

This research assessed the rehabilitation priority by modifying the 6 factors mentioned above into 3 factors. The modification was aimed to simplify on field assessment based on rapid appraisal to three important, stabile and dynamic factors, which were the network infrastructure condition (scoring 10 to 50), water availability (scoring 6 to 30) and irrigation area (scoring 4 to 20, see Table 2).

Figure 1. The locations of the nine command areas

Table 1. Name, area and classification of each command area

No	Name	Area (ha)	Classification
1	Krasak	30	Small, semi technical irrigation
2	Tegalduren	83	Small, technical irrigation
3	Ploro	225	Average, technical irrigation
4	Cluwek	336	Average, technical irrigation
5	Guntur	396	Average, technical irrigation
6	Penungkulan	581	Medium, technical irrigation
7	Kalisemo	599	Medium, technical irrigation
8	Kalimeneng Kanan	952	Big, technical irrigation
9	Kedunggupit Kulon	993	Big, technical irrigation

However, such rapid appraisal faced several obstacles on field. Assessing the irrigation network infrastructures should be classified into several components and scored. The network infrastructures within the technical irrigation, such as weirs, channels, division structures, embankment and inspection road (EIR), and discharge measurement structure (DMS) were scored as presented on Table 3. The scoring was based on the structure function to the intaking, flowing, divisioning, and distributing process of irrigation water. The largest score was given to weir as the main intake structure and

subsequently followed by channel for flowing function, other structures for divisioning and distributing function based on the demands. Detailed scoring to damage infrastructures is shown on Table 4, 5, 6, 7 and 8. Total damage classification of infrastructure of irrigation system can be seen on Table 9.

REHABILITATION OF THE IRIGATION INFRASTRUCTURE

The management of an irrigation network system is an integrated and synchronized operational and maintenance activity. Maintenance is an activity assuring the service function and irrigation water to flowing properly to the paddy field blocks based on the necessities within the technical irrigation network. The objective is to support the operational service in continually providing irrigation water. It consists of continual preservation, reparation, prevention and securing assets of the irrigation network. To prevent decreasing service function, either partial or total rehabilitation is necessary. Pusposutardjo (1996) suggested extending water management by farmers not only to tertiary but also to secondary and even to primary blocks. This indicates that the operational and maintenance activities, including rehabilitation, are under the responsibility of both farmers and governments.

Bappenas (2000) stated that irrigation network rehabilitation was financed by APBN projects and has generated significant amount of liability but without solving the actual problem. Nurbaya (2002) explained that during 20 years, the national expenditures for irrigation infrastructures were significant assets and consequently resulted in significant management expenditures, including the rehabilitation costs. The farmers' dependency to the center government was somehow negative and inconsistence to the revitalization of the irrigation management policy (PKPI).

The decision support system of rehabilitation for all irrigation area in Indonesia has not been either well structured or based on priority scale. It is a burden to solely one particular institution. Such condition is considerably different to decision support system of operation, which is based on crop pattern and schedule composed and agreed by various related institution, including the farmers as the subject. Bruns (2000) stated that rehabilitation required incidental investment. Financing rehabilitation sometimes entails significant amount of fund which often exceeds the kabupaten government and the farmers' financial capability. Financing the rehabilitation should be budgeted within APBN and APBD in Bappeda. Such financing can be assigned based on the request of the farmers request to kabupaten government or from kabupaten government to central government based on the priority assessment (Bappenas, 2000).

Table 2. Classifications of rehabilitation assessment

No	Factor	Classification	score
1	Damage infrastructure	Heavy damage	50
		Moderate damage	40
		Light damage	20
		Good condition	10
2	Water availability in 1 year (months)	12	30
		9 – 12	24
		6 – 9	12
		< 6	6
3	Area (Ha)	501 – 1000	20
		201 – 500	16
		151 – 200	8
		0 – 150	4
4	Priority	First	100
		Second	80
		Third	40
		Forth	20

Table 3. Classifications of the infrastructure scoring

No	Infrastructure	Heavy damage		Moderate damage		Minor damage		Good condition	
		%	Score	%	score	%	score	%	score
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Weir	50.00	25.00	37.50	20.00	18.75	10.00	12.50	5.00
2	Channel	20.00	10.00	15.00	8.00	7.50	4.00	5.00	2.00
3	Division structure	10.00	5.00	7.50	4.00	3.75	2.00	2.50	1.00
4	EIR	15.00	7.50	11.25	6.00	5.63	3.00	3.75	1.50
5	DMS	5.00	2.50	3.75	2.00	1.88	1.00	1.25	0.50
	Total score	100.00	50.00	75.00	40.00	37.50	20.00	25.00	10.00

Table 4. Classifications of weirs damages

Weir	Weight	
	%	Score
Weir body	50	25.00
Intake	20	10.00
Stilling basin	10	5.00
Downstream side	5	2.50
Upstream side	5	2.50
Gates	5	2.50
Intake gate	5	2.50
	100	50.00
Total (see Table 3, column 4, row no.1)	50%*50=25	

Table 5. Classifications of channel damages

Channel (earth/lined)	Weight	
	%	Score
Landslide	25	5.00
Foundation	25	5.00
Sedimentation	25	5.00
Covered by grass	25	5.00
	100	20.00
Total (see Table 3, column 4, row no.2)	20%*50=10	

Table 6. Classifications of division structure damages

Division structure	Weight	
	%	Score
Main structure	50	5.00
Foundation	20	2.00
Stilling basin	10	1.00
Downstream side	5	0.50
Upstream side	5	0.50
Gates	10	1.00
	100	10.00
Total (see Table 3, column 4, row no.3)	10%*50=5	

Table 7. Classifications of embankment and inspection road damages

Embankment and inspection road	Weight	
	%	Score
Inspection road	10	1.50
Inside embankment	50	7.50
Outside embankment	40	6.00
	100	15.00
Total (see Table 3, column 4, row no.4)	15%*50=7.5	

Table 8. Classifications of discharge measurement structure damages

Structure	Weight	
	%	Score
Crest	50	2.50
Discharge / depth board	20	1.00
Screw	10	0.50
Screw steer	5	0.25
Gate	5	0.25
Frame	5	0.25
Peilschaal	5	0.25
	100	5.00
Total (see Table 3, column 4, row no.5)	5%*50=2.5	

Table 9. Damage classifications

No	Score	Damage classification
1	50	Heavy
2	45 – 50	heavy – moderate
3	40 – 45	moderate – heavy
4	40	Moderate
5	30 – 40	moderate – minor
6	20 – 30	Minor – moderate
7	20	Minor
8	15 – 20	Minor – good
9	10 – 15	Good – minor
10	10	Good condition

RESULTS AND DISCUSSION

Total damaged irrigation infrastructure was based on the assessment to weirs, channels, division structures, embankment and inspection road, and discharge measurement structures. Damaged condition was scored based on Table 4 to 8 and classified according to Table 9. Examples of severe damage (total disfunction to irrigating), average damage (part of irrigation water cannot flow through the channels), minor damage (normal irrigation function but with some damages) and no damage with excellent flowing function are presented in Figure 2.

Based on rapid appraisal to the irrigation network infrastructure on field condition, by observing the flowing function of totally disturbed, partially disturbed, and undisturbed flow and also based on the assessment criteria for each structure (see Table 4 to 8), Then, the results can be seen on Table 10, with total score on Table 11.

Table 10. Results of rapid appraisal to the conditions of irrigation network infrastructure

Name of infrastructure	Guntur	Penung-kulan	Kali-semo	Krasak	Tegal Duren	Ploro	Cluwek	Kali-meneng Kanan	Kedung-gupit Kulon
Weir	6.3	6.3	6.3	12.8	24.1	6.9	6.3	6.3	6.3
Channel	5.0	7.5	6.3	3.1	6.9	4.4	5.0	5.6	4.4
Bangunan	1.8	1.6	1.6	2.4	3.8	2.7	2.8	1.6	1.6
Embankment & inspection road	3.0	3.2	4.1	2.1	5.8	3.8	3.0	3.8	2.8
Device	0.8	0.7	0.8	2.4	2.5	1.1	1.1	0.7	0.8
Total	16.8	19.3	19.0	22.8	43.1	18.8	18.2	18.0	15.9

Table 11. Results of the analysis in rehabilitation priority

No	Name	Infrastructure condition		Water availibility in 1 year (months)		Functional area		Total	Priority
		Classifi-cation	score	No. of months	score	Area (ha)	score		
1	Krasak	minor – moderate	22.78	12	30	30	4	56.78	9th
2	Tegal Duren	Moderate–heavy	43.06	9 – 12	24	83	4	71.06	1st
3	Ploro	minor – good	18.78	9 – 12	24	225	16	58.78	7th
4	Guntur	Minor – good	16.81	12	30	326	16	62.81	6th
5	Cluwek	minor – good	18.16	9 – 12	24	336	16	58.16	8th
6	Penungkulan	Minor – good	19.28	12 (limited area)	27	581	20	66.28	2nd
7	Kalisemo	Minor – good	19.00	12 (limited area)	27	599	20	66.00	3th
8	Kalimeneng Kanan	Minor – good	17.97	12 (limited area)	27	952	20	64.97	4th
9	Kedunggupit Kulon	Minor – good	15.90	12 (limited area)	27	993	20	62.90	5th

(a) heavy damage (b) moderate damage

(c) minor damage (d) good condition

Figure 2. The channel damage condition.

Small Command Areas

Krasak and Tegalduren are small command areas with different service classification. Krasak command area is served by technical irrigation, and Tegalduren is served by semi technical irrigation system. Technical and semi technical irrigation system management for small areas (less than 100 ha) has been handed over to the water users' association (WUA), including the operational and maintenance responsibility, as well as rehabilitation. The farmers' helplessness, especially in rehabilitating, has caused infrastructure damage especially for the weir. Results of rapid appraisal showed that the first rank was Tegalduren command area (43.06%) with Krasak at the second (22.78%). These indicate that farmers in Tegalduren command area were helpless in rehabilitating the irrigation network. Such condition was resulted from significant amount of cost to repair the simple weir structure, which was damaged by flood event. As much as Rp. 1,000,000 Irrigation Service Fee (ISF) provided by the farmers will never be enough for rehabilitation project. The score variation in water availability factor between Krasak and Tegalduren was 6 (see Table 10) and because Tegalduren was situated on Krasak downstream. Scores for area factors are the same (score 4 on Table 10). The total scores for Tegalduren and Krasak are 71.06% and 56.78%, respectively. These scores showed that Tegalduren has more priority than Krasak. The total score of the nine command areas resulted in Tegalduren as the first priority and Krasak for the ninth (last) priority. Programs to transfer small command areas (less than 100 ha) has been carried out by Kabupaten Purworejo Government since 1992. As a small command area, Tegalduren has not been a technical irrigation system and required to be improved to technical before being handed over to WUA. Revitalization to irrigation management policy (PKPI), including rehabilitation, has not been appropriately accomplished. This is because the right for main network management is the government's. WUA has the right for management and utilization only at tertiary level, indicating there has not been equal right between the government and farmers [5].

Nurbaya (2002) also stated that operational and maintenance were often disregarded in cost allocation. It is necessary to more activating the irrigation service fee (ISF) by WUA in order to continue the rehabilitation activities by means of simultaneous financing from the Kabupaten Government of Purworejo .

Average, Medium and Large Command Area

Guntur, Ploro and Cluwek were average command areas with technical service classification. Kalisemo and Penungkulan were medium, both Kalimeneng Kanan and Kedunggupit Kulon were large command areas. All medium and large command areas were technical. Average command area with similar structure and channel length variations comprised damage classification that ranged from 16% to 19%. Such damage conditions in average command areas were lower than those in medium command areas, which ranged between 19% to 20%. It indicated that maintenance in average command areas was better than in medium command areas. Maintenance in large and medium command areas were in balance and received the same attention from the Kabupaten Government of Purworejo.

Water availability in medium and large command areas was significantly better than the average command areas. Such condition was supported with water supply into large and medium command areas from Wadaslintang Dam. More water availability assurance in providing irrigation service would be paid more attention than command areas without water availability throughout the year. Rapid appraisal indicated that water availability in medium command areas was much better than in average command areas. This influenced the final results of the rapid appraisal. Medium and large command areas with water availability throughout the year would be given more rehabilitation priority than medium command areas without water availability throughout the year. Total and final results of the appraisal described that rehabilitation priority would rank from large, medium to average command areas. The three types of command areas were technical. The rehabilitation carried out by the Kabupaten Government of Purworejo was based on the priority scale. The purpose of simultaneous irrigation water fulfillment would be achieved if adequate attention from the Kabupaten Government of Purworejo , especially in rehabilitation projects, is given by allocating the project into APBD. Empowering the WUA should be taken by the government especially in planning the rehabilitation of irrigation infrastructure based on priority scale. Rehabilitation of the irrigation infrastructure is essential and needs to be comprehended by the decision makers (bureaucrat, DPRD, Non Government Organization) to avoid it being neglected and particular investment being cut (Nurbaya, 2002).

CONCLUSION

The analysis results of rehabilitation priority on the nine command areas in Kabupaten Purworejo can be detailed below.

1. Rehabilitation to semi technical command area, including small command area, is necessary to be done by the government. Irrigation management transfer (PPI) for small command areas is suggested for technical the ones.
2. As a semi technical irrigation system, Tegalduren needs to be improved to technical by rehabilitating the simple weir to become technical weir and positioned in first priority.
3. Rehabilitating the irrigation infrastructure, as the responsibility for Kabupaten Purworejo Government, was based on the priority scale. The priority scale started from large command areas (Kedunggupit Kulon and Kalimeneng Kanan), and then followed by medium command areas (Kalisemo and Penungkulan) and average command areas (Cluwek, Guntur and Ploro).
4. It is necessary for the decision makers to understand and not to neglect the routine maintenance.

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