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Evaluation of the Performance of Dams and Irrigation Networks in the Kalibumi Irrigation Area in Nabire Regency

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ABSTRACT

Development of the irrigation district (DI) in Nabire district began in 1972/1973 until 2014 the government carried out 6400 ha. The purpose of this study is to evaluate the performance of the wells and networks of the irrigation areas of the caliber. The results of this study show that the performance of Nabire's wells and irrigation networks that have been awakened is still low and requires attention with an overall value of 64.74% consisting of the performance value of the physical Prasarana 24.34%, plant productivity of 9.86%, the supporting networks 3.33%, the Organization of Personnel 9.18%, Documentation 2.74% and P3A/GP3A / IP3A 5.37% This indicates that the existing operating and maintenance system is still very poorly by the Regulation of the Minister of Public Works and People's Housing No. 12/PRT/M/2015 on the Exploitation and Maintenance of Irrigation Networks as assessed using the e-PAKSI application.

Introduction

In the era of reform and regional autonomy, the problem that has been faced by the government in carrying out food security improvement programs is the damage to irrigation network infrastructure as a system that functions to supply water to agricultural land in the regions (Permadi, Anwar, & Purnomo, 2019). In general, this damage is caused by natural disasters and less optimal irrigation management of irrigation infrastructure (Wanyama et al., 2017). The lack of optimal irrigation management is in the form of weak operation and maintenance (OP) activities carried out by irrigation managers. Irrigation network OPs, especially dam OPs, are always less prioritized than rehabilitation, improvement, and new development activities (Putu Indah Dianti Putri, Suputra, & Nuraga, 2022). To support the fulfillment of the community's water needs, and to support national food security in the agricultural sector, the government has implemented various programs, including the irrigation dam construction program and its facilities. The irrigation dam construction program is intended to meet the needs of agricultural water

and water in existing communities and support the mission of strengthening rice self-sufficiency is also directed to support the government's efforts to improve farmers' welfare, create jobs, improve the quality of the environment, especially in rural areas and alleviate poverty (Hamakonda, Taus, Lea, & Ludji, 2022).

As a result, the damage to irrigation infrastructure occurs little by little without realizing it until the stage of heavy damage which causes the performance of the irrigation system to decline. The government's problems in optimizing OP activities are caused by the limited data on the condition of irrigation networks that are relevant to the current conditions provided by irrigation managers, especially irrigation networks that have a very large area. (Mulyandari, Handoyo, Mawandha, & Kesuma, 2022). Nabire Regency is one of the rice field centers and the second largest after Merauke Regency in Papua Province (Papua TPH Office, 2014; BPS Papua, 2015). From this district, West Nabire District (Kampung Bumi Raya), Makimi District (Kampung Biha), and Wanggar District (Kampung Bumi Mulia) were determined as the largest irrigated rice field centers and those that carried out regular planting for at least the last two years. The development of Irrigation Areas (DI) in Nabire Regency began with the entry of the transmigration program in Girimulyo Village in 1972/1973, transmigration in Wonorejo in 1976/1978, and transmigration in Kalibumi in 1980 with a rainfed rice field system. Meanwhile, the development of new technical irrigation began with the construction of the Kalibumi Dam which began in 1996, and the development of primary and secondary networks in Kalibumi Kanan covering an area of 4,400 ha. Then in 2014, the Ministry of Public Works and Public Housing through the Directorate General of Water Resources of the Papua River Regional Center built the Kalibumi Kiri irrigation network which will serve 2,000 ha of agricultural land. (Setyawati, Zulkarnain, & Darmaputra, 2014).

However, the performance condition of the dam and irrigation network in Kalibumi Kanan has not been able to serve all planned agricultural land. Therefore, the performance assessment of the Dam and Irrigation Network must continue to be carried out to find out the problems that cause the performance of the dam and irrigation network to decline so that maintenance steps or actions can be taken to maintain the function of the dam and irrigation network of the Kalibumi Irrigation Area. (Ramdhani, 2020).

Research related to the performance of dams and irrigation networks has been carried out by previous researchers, namely:

Nurmala, Nurdiyanto, 2018. Analysis of bending performance of Soka Hilir, Dukupuntang District, Cirebon Regency. The Soka Hilir Dam was built in 1925 and is located in Sindangjawa Village, Dukupuntang District, Cirebon Regency. At the beginning of the construction of this dam served an irrigation area of 461 Ha, but currently only 258 Ha is irrigated by the dam. This is due to the mutation of the area that causes the narrowing of the irrigation area. Factors that affect the irrigation system at the Soka Hilir Dam include increased sedimentation in the river, as well as damage to facilities and infrastructure that results in ineffective and efficient irrigation water management and a lack of balance between available discharge and required discharge. (Puro, Mulyo, & Balapadang, 2020).

The purpose of this study is to analyze the condition and function of the irrigation network, analyze the institutional personnel and human resources that manage, analyze the hydrology of the river, available discharge and demand discharge, analyze planting patterns, analyze O&P costs, and analyze the performance priorities of the Soka Hilir Dam based on the AHP (Analytic Hierarchy Process) method. (Eka Wulandari Srihadi Putri, Harisuseno, & Purwati, 2015).

The conclusion obtained from the results of the analysis is that the condition and function of the Soka Hilir Dam irrigation area network are classified as moderate, institutional personnel are only 3 people short of the required discharge, mainstay discharge can meet the demand discharge, all alternative planting patterns can be fulfilled by mainstay discharge, O&P costs have increased in 2017 and decreased in 2018, Priority determination using the AHP method which is more than 5 prioritized is Maintenance Costs for dams and irrigation areas with a weight of 56.55%.

The objectives of this research are:

1. Analyzing the performance of dams and irrigation networks in the Kalibumi irrigation area of Nabire Regency
2. Analyze the appropriate Operation and Maintenance system based on the results of the performance assessment of the dam and network carried out
3. Determine strategies and policies for improving the performance of the dam and network.

Method

This research is located in the Kalibumi Irrigation Area. The Kalibumi Dam is included in the area of Kampung Bumi Raya, Wanggar District, Nabire Regency. Geographically, the Kalibumi Dam is located at 1350 25 E and 3024' – 30 28' LS, which is southwest of the city of Nabire and can be reached by land by motorized vehicle for ± 30 minutes. The irrigation network used for research is the Kalibumi Kanan Irrigation Network with a planned service area of 4,400 hectares. (Sugiyono, 2016).

The method that will be carried out in this study uses a descriptive research method with a combination of qualitative and quantitative research methods (mixed methods). The data taken are primary data and secondary data.

1. Primary data

The primary data collected is the result of measurement surveys and observations in the field which contain information on the condition of dams and irrigation networks as well as interviews with users and managers of dams and irrigation networks in Kalibumi.

2. Secondary data

Secondary data are document data related to dams and irrigation networks in Kalibumi (network scheme and building scheme) as well as other irrigation area identity data related to dam management and irrigation networks such as water availability, raw area, functional area, and potential area. Secondary data related to network schemes and

building schemes provide an overview of the location and names of buildings and irrigation canals equipped with the nomenclature of each building and channel in the irrigation area. In this application-based research on Electronic Asset Management and Irrigation System Performance (EPAKSI), the observed data is recorded and input directly into the observation sheet that is available in the EPAKSI application.

Results and Discussion

Results of the Performance Assessment of Dams and Irrigation Networks based on EPAKSI

Based on the results of the EPAKSI-based performance analysis that adjusts to the technical instructions for irrigation asset management, the condition and function of the Kalibumi dam and irrigation network assets (can be seen in the attachment) can be described as follows.

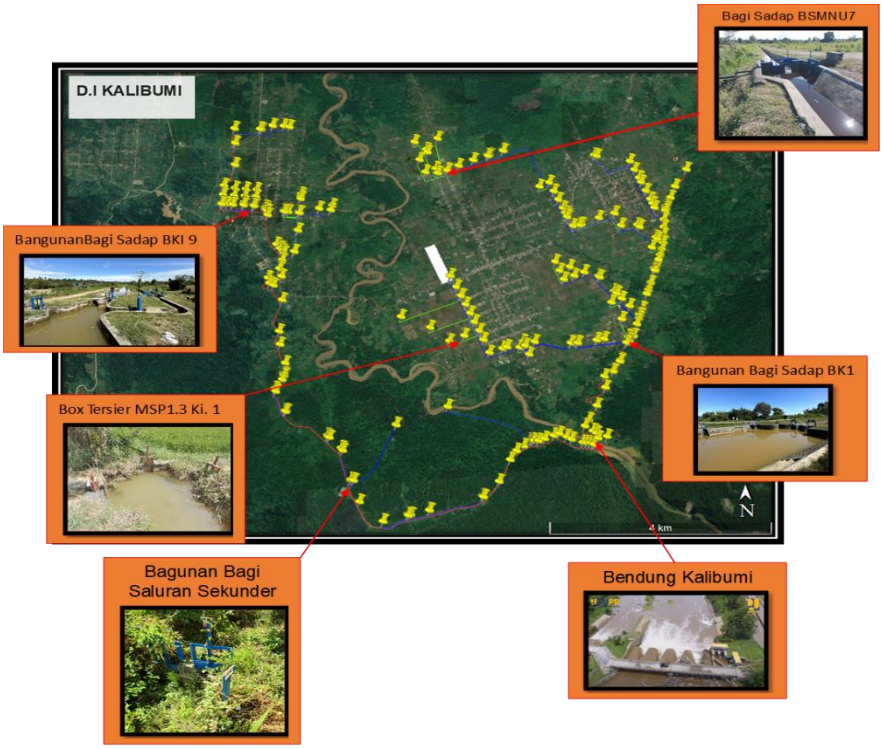

Figure 1 Results of Kalibumi Building and Irrigation Network Inventory

Assessment of the performance of dams and irrigation networks based on the assessment of the Real Needs for Operation and Maintenance (AKNOP) and EPAKSI

The Performance Assessment and AKNOP of the Condition of the Irrigation Network in Kalibumi is a periodic activity that is carried out to inventory the condition of the irrigation infrastructure building and to analyze the performance level of the irrigation infrastructure building and calculate the cost of the real need for operation and maintenance (AKNOP) of the irrigation infrastructure building which is used as the implementation of the Operation and Maintenance of the Condition of the Irrigation Network in Kalibumi.

Based on the data obtained from previous assessments of the Kalibumi dam and irrigation network, it is known as follows:

a. Performance Assessment and AKNOP of the Condition of the Irrigation Network in Kalibumi in 2021

From the results of the assessment of the performance value of DI Kalibumi carried out by consulting services (consultants), it is known that the performance value of DI Kalibumi is 73.39%, included in the category of good performance as shown in the following table:

Table 2
Recapitulation of the 2021 Kalibumi Irrigation Network OP Performance Assessment

Komponen Indeks Kondisi OP Jaringan Irigasi	Yang ada (%)	Maks (%)	Min (%)	Optimum (%)
Prasarana fisik	31,13	45	25	35
Produktivitas tanam	7,91	15	10	12,5
Sarana penunjang	9,60	10	5	7,5
Organisasi personalia	14,40	15	7,5	10
Dokumentasi	4,30	5	2,5	5
P3A	7,05	10	5	7,5
Total	**74,39**	**100**	**55**	**77,5**

b. Performance Assessment and AKNOP of the Condition of the Irrigation Network in Kalibumi in 2023 with EPAKSI

From the results of the assessment of the performance value of DI Kalibumi carried out by the EPAKSI officers of the Papua River Regional Center, it is known that the performance value of DI Kalibumi is 64.74%, including in the category of Poor Performance and Needs Attention performance as shown in the following table:

Table 3
Recapitulation of the 2023 EPAKSI Kalibumi Irrigation Network OP Performance Assessment

SISTEM IRIGASI UTAMA				SISTEM IRIGASI TERSIER				NILAI TOTAL
No.	KOMPONEN	Indeks Kondisi Yang Ada	Bobot (80%)	No.	KOMPONEN	Indeks Kondisi Yang Ada	Bobot (20%)	
1.	PRASARANA FISIK	30,43	24,34	1.	PRASARANA FISIK	16,06	3,21	27,55
2.	PRODUKTIVITAS TANAM	12,33	9,86	2.	PRODUKTIVITAS TANAM	9,00	1,80	11,66
3.	SARANA PENUNJANG	4,17	3,33	3.	KONDISI OP	11,50	2,30	5,63
4.	ORGANISASI PERSONALIA	11,48	9,18	4.	PETUGAS PEMBAGI AIR	10,50	2,10	11,28
5.	DOKUMENTASI	3,43	2,74	5.	DOKUMENTASI	2,53	0,51	3,25
6.	P3A/GP3A/IP3A	6,71	5,37	6.	P3A	0,00	0,00	5,37
		68,53	**54,83**			49,59	**9,92**	64,74

SWOT (Strenght Weakness Opportunity Threat) from the Kalibumi Irrigation Area

The following is the SWOT (Strength Weakness Opportunity Threat) of the Kalibumi Irrigation Area, Nabire Regency.

Strength	*Weakness*	*Opportunity*	*Threat*

Availability of Water Supply for Irrigation Areas	Performance assessment is carried out 1 time a year	Dam and network damage management	Network damage repair is still slow to be implemented
Operation and Maintenance Implementation	Coaching for the younger generation of farmers is still lacking	Uses and benefits of the e-Paksi application	Operations and Maintenance are still unimplemented
Uses and Benefits of the e-Paksi Application	Utilization of Facilities and Infrastructure is still lacking	Increased planting productivity	The loss of generations of farmers in DI Kalibumi
Facilities and Infrastructure available	Farmer Institutional Development is still lacking	Opening of new farmland	The switch of farmers to other occupations
		Support from the Central and Regional Governments	

After doing the SWOT, the next thing to do is to recalculate, namely the score and weight of each SWOT. And get a score for strength of 3.81, a weakness value of 3.60, an opportunity value of 2.83, and the last is a threat of 3.66 So after that there will appear which handling and direction of recommendations need to be prioritized first.

STRENGTHS	**OPPORTUNITIES**
• Water supply for irrigation networks is still abundant • The implementation of Irrigation OP continues to be carried out • Repairs to damaged irrigation canals continue to be carried out • The implementation of Irrigation OP depends on the Application of Irrigation	• The results of the Epaksi Assessment are a determining indicator of the OP of the dam and the network • Epaksi applications are more efficient and effective in their use • There is an increase in planting productivity • Allows for the opening of new farmland • Receiving support from the government

• Facilities and infrastructure for irrigation areas are available	

WEAKNESS	**THREATS**
• Irrigation OP is still constrained by social problems • It is necessary to conduct a field survey to determine the cost of damage • Assessment of the performance of the dam and network is still lacking • Coaching for the younger generation of farmers is still lacking • The use of facilities and infrastructure is still lacking • Institutional development of farmers' associations is still lacking	• Damage to irrigation networks is getting worse due to late handling • Operation and maintenance of irrigation networks are still very minimal • Loss of generations of farmers • The switch of farmers to other occupations • The increasing difficulty of developing new agricultural land

From the results of the compilation of potentials and problems above, to produce a handling strategy that can improve the performance of the Kalibumi Nabire dam and irrigation network, it is necessary to pay attention to the combination of SWOT analysis with a strategy that is adjusted based on the potential and problems as follows:

	Opportunity	***Threat***
Strength	S-O: Using power to seize opportunities	S-T: Using Strength to avoid threats
Weakness	W-O: Overcoming weaknesses by	W-T: Minimizing weaknesses

	taking advantage	and avoiding threats
	Opportunity	***Threat***
	S-O Strategy	*S-T Strategy*
Strength	• Optimally utilize the availability of water, irrigation facilities, and infrastructure in the form of main buildings and carrying canals to irrigate agricultural areas • The use of the e-Paksi application is the main key to the implementation of operations and maintenance • Existing irrigation facilities and infrastructure are used to support increasing planting productivity	• The implementation of operations and maintenance must be carried out more often to prevent infrastructure damage from getting worse • Coaching for the younger generation of farmers must be carried out more massively to support the generation of farmers in the Kalibumi irrigation area • Cooperation with farmers in maintaining facilities and infrastructure must continue to be improved
	W-O Strategy	***W-T Strategy***
Weakness	• Involving residents in	• Operations and Maintenance are

	maintenance work to avoid social problems • The implementation of the dam and network performance assessment using the e-Paksi application is carried out together to directly ascertain the amount of damage that occurs • Farmer development continues to be carried out so that the increase in planting productivity can be increased • Institutional development of farmers' associations involves relevant stakeholders	carried out by involving security forces to avoid social problems • The development of the younger generation of farmers must be carried out by involving the younger generation so that they are more motivated to develop the agricultural sector • Institutional development continues to be carried out by involving all members of farmers' associations to avoid farmers changing professions.

Strategy for Optimizing the Performance of Dams and Irrigation Networks

From the results of the SWOT analysis, strategies that can be carried out to increase park productivity in the Kalibumi Nabire irrigation area can be determined as follows:

1. Continue to pay attention to the forest protection function area to maintain the sustainability of the Kalibumi River water flow
2. Utilizing all facilities and infrastructure that have been built to continue to increase planting productivity in the Kalibumi Nabire irrigation area
3. The implementation of operation and maintenance should be carried out 3 times a year to detect and accelerate repairs to damage that occurs in the carrier network infrastructure
4. Utilizing the e-Paksi application as a guide to carry out operations and maintenance by involving other officers to assist in the calculation of the magnitude of the damage that occurred
5. Coaching to institutions and farmer groups is carried out at least 2 (two) times a year to continue to embrace farmers and create a younger generation of farmers
6. Encourage cooperation between the River Region Center and related agencies to increase the productivity of planting and development of potential land.

Conclusion

The performance of the Kalibumi dam and irrigation network in the Kalibumi irrigation area can be seen that the performance of the dam and irrigation network in the Kalibumi Irrigation Area is in the condition of Less Performance and Needs Attention with an overall value of 64.74%. The operation and maintenance system that has been carried out is still considered insufficient based on the assessment of the e-PAKSI application and the Regulation of the Minister of Public Works and Public Housing number 12/PRT/M/2015 concerning Exploitation and Maintenance of Irrigation Networks with a value index of 55 to less than 70. For this reason, it is necessary to improve the implementation of operations and maintenance on the Kalibumi dam and irrigation network. The results of the use of the e-Paksi application have greatly helped the Papua River Regional Office in determining the performance conditions of the network dam so that it can determine the handling of the facilities and infrastructure of the Nabire irrigation area.

Strategies and policies in improving the performance of dams and networks based on the SWOT analysis carried out include:

a) Utilizing all facilities and infrastructure that have been built to continue to increase planting productivity in the Kalibumi Nabire irrigation area
b) The implementation of operation and maintenance should be carried out 3 times a year to detect and accelerate repairs to damage that occurs in the carrier network infrastructure
c) Utilizing the e-Paksi application as a guide to carry out operations and maintenance by involving other officers to assist in the calculation of the magnitude of the damage that occurred

d) Coaching to institutions and farmer groups is carried out at least 2 (two) times a year to continue to embrace farmers and create a younger generation of farmers
e) Encourage cooperation between the River Region Center and related agencies to increase the productivity of planting and development of protected land

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