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Evaluation of Irrigation Network Performance in Irrigation Areas Jegong Suren Village, Ledokombo District Jember Regency with E-PAKSI

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Abstract:
It is necessary to evaluate the irrigation system to ensure that services are increasing, sustaining or even decreasing. Evaluation of irrigation services is very dependent on the condition of the buildings and irrigation canals that have been built. This study aims to obtain the index value of the irrigation area performance assessment so that the output is in the form of recommendations on buildings and irrigation canals in detail then the calculation of repair costs and maintenance and operational costs on the Jegong Irrigation Network in Suren Village, Ledokombo District, Jember Regency. With the help of the E-Paksi application and conducting field searches, it was found that the performance appraisal parameter (IKSI) was 61.88%, then DI. Jegong entered the assessment criteria 3 with a weight value of 55 – 69 (less performance and needs attention). The criteria for the condition of the physical infrastructure, the combined performance assessment index value is in the moderate condition category (60% - 80%) meaning that the irrigation network requires periodic maintenance, the results of the irrigation network performance assessment show that the real operation and maintenance requirement (AKNOP) is IDR. 629,415,000.00 the cost of maintaining the irrigation network is IDR. 17,293,000.00.

Keywords: *Performance, Service, Irrigation, IKSI, AKNOP*

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I. Introduction

To ensure an Irrigation Area (DI) can provide services in a sustainable manner, it must have an adequate irrigation network system. Adequate food availability can be realized by efforts to improve irrigation infrastructure, especially in irrigation networks that have been damaged [1]. Irrigation channel is a channel consisting of complementary buildings that function to distribute water, discharge water, and provide irrigation water [2]. Given these problems, the main thing that needs to be known is the performance of the irrigation system. Performance is the quality and quantity of work obtained to carry out their duties in accordance with the assigned tasks [3]. Circumstances like this make it obligatory to evaluate the performance of the irrigation system because then it will know the performance of the irrigation system that has a status which includes water user farmers, documentation, crop productivity, personnel organization, supporting facilities and physical infrastructure [4]. Unfulfilled irrigation water in a growing season can be caused by several factors, including: limited water flow for irrigation, the occurrence of illegal tapping, the occurrence of water loss caused by inadequate conditions of the existing irrigation network. Provision of irrigation water as needed can increase the productivity of agricultural products. The productivity of rice plants will be good if the fulfillment of irrigation water for rice plants is sufficient. Therefore, irrigation facilities and infrastructure for agriculture need to be maintained so that the distribution of irrigation water can be consistent in meeting crop needs. Ministerial Regulation Number 12 of 2015 contains Guidelines for Exploitation and Maintenance of Irrigation Networks containing six aspects, namely the condition of associations of farmers using water, documentation, maintenance operations, personnel organization, crop productivity, crop productivity and physical infrastructure [5].

Then the fuzzy concept itself can determine the level of truth represented by 2 (two) assessment criteria based on the degree of membership [6]. In order to improve the function and extend the life of the weir and the network that has been built, it is necessary to evaluate the performance of the Jegong Irrigation Area, Jember Regency which is in the Suren Village area, Ledokombo District, so that it can work optimally in service to the community and as a guide for managers in carrying out management (management).) Operation and maintenance of irrigation networks. The puIDRose of this research is to find out how the condition of buildings

and canals is and to know the value of the performance appraisal index, to know the recommendations that are in accordance with the conditions and the value of the performance appraisal index and to calculate the repair and maintenance costs and the operation of the Jegong Irrigation Area, Suren Village, Ledokombo District, Jember Regency. Food security can be achieved with existing resources in 2025 if and only if the implementation of appropriate water management measures is realized [7], demand in Indonesia is supported by Indonesia's irrigation policy reforms that produce sustainable positive impacts [8]. By expanding the scope and improving the quality of implementation, it is likely that rice production will continue to increase. According to a study, irrigation maintenance has helped improve irrigation systems [9].

II. Material And Methods

Jegong Dam main irrigation water comes from 2 (two) rivers from the foot of Mount Raung, namely the Dampar river and the SumberSalak river. These two rivers are tributaries of the Mayangriver. So the Dampar river and the SumberSalak river are included in the Mayang Watershed (DAS).Irrigation systems depend on irrigation water extraction techniques, operating patterns and irrigation system managers [10]. Based on the status of the irrigation network, the irrigation system is divided into 3, including: (KPUPR, 2017): Government Irrigation: is an irrigation network built and managed by the government, either the central government or local government, Village Irrigation: is an irrigation network built and managed by the village community, Private Irrigation: is an irrigation network built and managed by the private sector or individuals for their own puIDRoses, for example if the private sector opens a plantation business, it can build and manage irrigation networks for its own needs. According to PUPR Ministerial Regulation Number 23/PRT/M/2015 concerning Management of Irrigation Assets, irrigation asset management is a structured management process for planning maintenance and funding of irrigation systems in order to achieve a defined and sustainable level of service for irrigation water users and irrigation network users with financing management of irrigation assets as efficiently as possible.

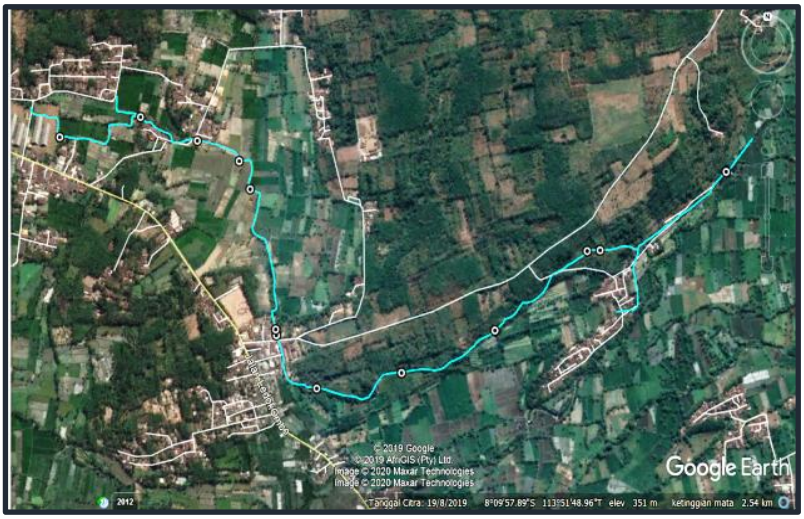

Figure 1: Research locations
*Source: Google Maps

Common-pool irrigation systems are characterized by competition for consumption and the difficulty of exclusion if not managed properly. Therefore, irrigation management is very important to take collective action based on collaborative efforts or cooperation of farmers in rural communities, for example through the Association of Water Users (P3A) [11]. The transfer of responsibility for irrigation management from government agencies to farmers has been important in many countries [12]. As a result, the participation of farmers, particularly in WUAs in irrigation management, has become the center of attention. Irrigators who were considered beneficiaries are now considered partners in the planning, development, operation and maintenance of irrigation systems. A study found that it is very important to create an enabling environment for farmers to realize the benefits and other economic benefits of participating in the maintenance of irrigation infrastructure [13]. The level of irrigation service is an important element in PAI, because the investment made in PAI must be linked to the level of service. irrigation in question. As for what is measured in the level of irrigation services is the performance of the irrigation system. Criteria for assessing the performance of the main irrigation system: The weight value of 80-100 is very good, Value of weight 70 – 79 good performance,The

weight value of 55 – 69 is less performance and needs attention,Weight value < 55 poor performance and need attention, Maximum 100, Minimum 55 and Optimum 77.5.

The research location is to evaluate the performance of irrigation networks in the Jegong Irrigation Area, Suren Village, Ledokombo District, Jember Regency. In collecting data, it is divided into 2, namely primary data and secondary data collection. Primary data collection is the collection of data obtained directly, while secondary data is data that is sourced from government agencies. The data needed to evaluate the performance of the irrigation network in the Jegong Irrigation Area (DI) are:

1. Secondary Data : Exploitation Schematic Map and Construction Schematic Map, Channel Discharge Data, Work Unit Price Analysis
2. Primary Data : Main Building Inventory, Complementary Building Inventory and Carrier Channel Inventory

The stages of the research are as follows:

a) Prepare a map of the exploitation and construction scheme as a reference for reviewing at the research site,
b) Download the e-Paksi application on the web https://epaksi.sda.pu.go.id
c) Starting to carry out an inventory of irrigation network physical assets (PAI) using the e-Paksi application,
d) After completing the inventory of irrigation network physical assets (PAI), then synchronizing PAI data in the settings menu on Android,
e) Furthermore, the surveyor reports to the PAKSI web manager at the relevant office that an inventory of physical irrigation assets (PAI) has been carried out for further editing, validation and verification on the PAKSI web,
f) After the editing process is carried out on the PAKSI web, the surveyor carries out an irrigation network performance assessment (IKSI), and after it is finished, the next step is to synchronize data,
g) After the irrigation network performance assessment activity (IKSI) has been completed, the manager then carries out editing, validation and data verification activities on the PAKSI web to get the index value of 6 indicators and their recommendations,
h) Next, calculate the Real Need for Maintenance Operations (AKNOP).

On the other hand, consideration of the affected area due to the condition of the building is also used as an additional consideration, and related to this consideration the details can be seen in the formula below. Therefore, the type of handling and priority of improvement need to be made based on the data: Area of Irrigation Area (Adi), Area of service affected by asset damage (Aas), Physical condition of irrigation network and physical function of irrigation network.

$$P = (K \times 0{,}35 + F^{1{,}5} \times 0{,}65) \times \left(\frac{Adi}{Aas}\right)^{-0{,}5}$$

With :

P = Priority
K = Condition score (see treatment recommendations section)
F = Function score (see treatment recommendations section)
A_{di} = Service area affected by asset damage
A_{as} = Area of irrigation area

Inventory of irrigation network assets must be carried out as the first step for updating irrigation network asset data. Through the e-Paksi android-based application, the inventory of irrigation network assets can be updated at any time. Because the irrigation network asset data that has been inventoried using the e-Paksi application is automatically stored on the central server of the Ministry of Public Works and Public Housing, Directorate of Water Resources. Assessment of irrigation system performance includes physical assessment and non-physical assessment. Physical assessment includes aspects of physical infrastructure carried out on the main building, complementary buildings, and existing channels in an irrigation network. Meanwhile, the non-physical assessment includes aspects of supporting infrastructure, aspects of crop productivity, aspects of personnel organization, aspects of documentation, and aspects of the Water User Farmers Association (P3A). However, in this study, the focus is on the physical assessment of the irrigation network consisting of the main building and the conveyance channel, the weight of the performance assessment per indicator is presented in a histogram.

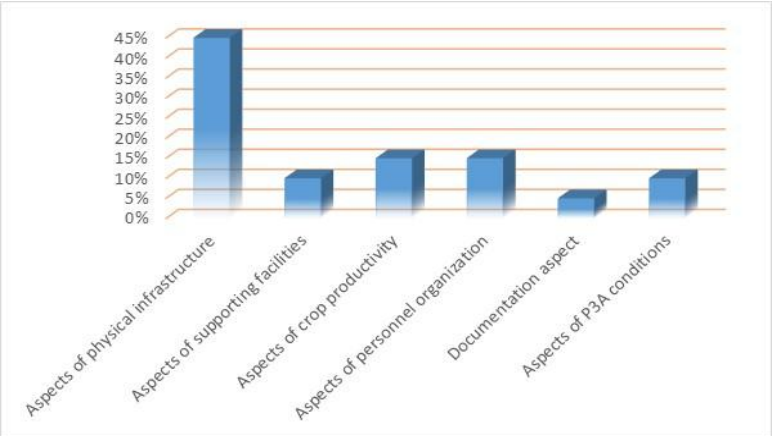

Figure 2:Histografaspects that are taken into account in epaksi

III. Discussion

The results of a search that has been carried out along the Jegong irrigation area, Suren Village, Ledokombo District, Jember Regency, the results show that the Jegong irrigation area in the main building from the intake gate to the Jegong 9 building or the last tapping building has a length of 3,127 meters and is a technical irrigation network. . The first step in implementing irrigation asset management activities is to carry out irrigation asset tracking activities. Based on the results of the search for irrigation assets from data collection in 2019, the Jegong irrigation area has building assets, including: 1 fixed weir, 1 mud bag, 9 tapping buildings, 4 plunge buildings, 2 bridges, 15 washing ladders, and 1 animal bath. As for the assets of the canal, the Jegong irrigation area has 9 canals starting from the intake building to the last tapping building with a length of 3,127 kilometers.

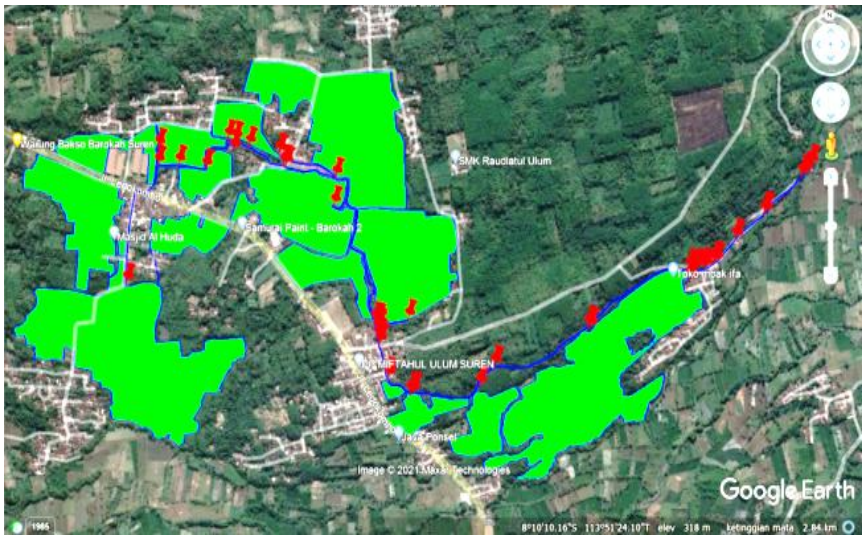

Figure 3:Inventory Result Map using the e-Paksi application

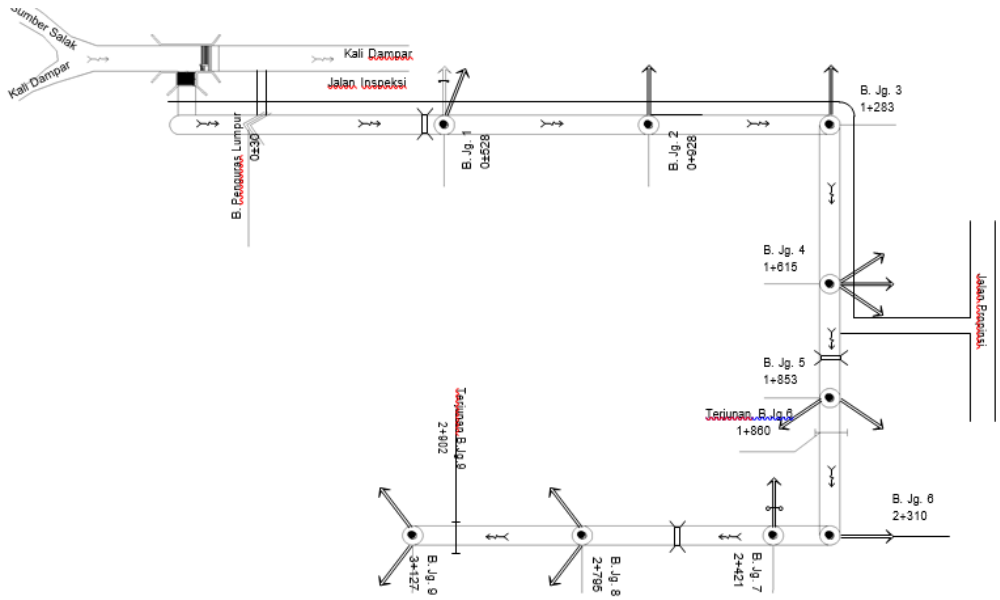

Figure 4:Irrigation Network Scheme in Jegong

After conducting a field inventory, the results of the condition of the water structure on the Jegong Irrigation Network in Suren Village, Ledokombo District, Jember Regency are as follows:

a. **WeirCrest :**The construction of civil buildings on the Jegong Dam lighthouse is still intact and in good condition. As for the existing condition, no significant damage was found to the civil building of the crest, only less than 20% of the surface of the dam crest was peeling off. The pillar on the drain door has a crack of less than 20%.

b. **Weir Wings :** The construction of civil buildings on the wing of the Jegong Dam on the right side at the time of the assessment looked good and in good condition. It is only necessary to clean the rising sedimentation so as to reduce the wet cross-sectional dimensions of the Dampar River. Meanwhile, the construction of the wing of the Jegong Dam on the left side at the time of the assessment appeared to be badly damaged. The damage began to be discovered in the performance assessment in 2019 which began to erode the lower part of the Jegong Dam wing construction building.

And in the 2020 performance assessment, the damage to the construction of the Jegong Dam wing is getting worse due to flooding during the rainy season. So the overall performance assessment for building construction on the wing of the Jegong Dam is in the medium criteria. At the Jegongweir there is no bridge over the lighthouse, operation board, and weir safety fence.

c. **Weir Floor Upstream** :The condition of the upstream dam floor is not visible because it is covered with water and sediment. The swimming pool is in good condition and the building damage is less than

20%. The condition of the leak on the dam floor is good. The condition of the riverbed at the upstream of the weir there is quite a lot of sedimentation. While in the downstream there is no change in the riverbed. The surface layer of the upper weir floor is not visible due to sedimentation, and the downstream part is also in good condition.

d. **Weir Embankment :**Overall the condition of the upstream and downstream dam capping embankments is good. It is only necessary to repair the left flank of the downstream side of the weir so that it does not affect the collapse of the left embankment and flood the agricultural area.

e. **Weir Bridge :**At Jegong Weir there is no bridge over the weir lighthouse, so the weir operational officers find it difficult to carry out maintenance activities on the part of the weir on the opposite side.
f. **Operation Board and Weir Ruler :**The Jegong Dam is not attached to an operation board. The operation board needs to be installed to make it easier to record the water debit both at the intake and at the drain door. In general the condition of the ruler is still in good condition and the numbers can be read quite clearly. The position of the ruler installation is also appropriate.

g. **Safety Fences on Weirs and Weir Doors :**At the Jegong weir there is no safety fence, in the future it will need to be installed as a security sign for state land boundaries. All doors can operate properly and smoothly. The condition of the door leaf, the door handlebar is installed in good condition, no damage or leakage was found. Lifting equipment (morheis) sill, steel spooring is in good condition and can be operated. The door guard house is in moderate condition, and needs to be treated so that it doesn't get damaged

Table 2. Calculation of building parameter in DI Jegong

No	Building Parameter	Condition	Value	Level significant	Final Scoring
1	Weir Crest				
	a. Mercu and weir body	Good	85	60	51
	b. Leak	Good	85	10	8,5
	c.Surface coating	Medium	70	10	7
	d. Pillar on the drain door	Good	85	20	17
2	Weir Wings				
	a. Left and right abutments, transmission walls (kirmir) and wings	Medium	70	70	49
	b. Surface Coating	Good	85	30	25,5
3	Floor Weir				
	a. Upstream floor, stilling pool and downstream floor / riprap	Medium	70	50	35
	b. Moderate riverbed degradation	Medium	70	20	14
	c. Good leak/piping	Good	85	20	17
	d. Surface coating	Good	85	10	8,5
4	Weir Embankment				
	a. Seepage, transverse, longitudinal cracks and seepage grooves	Good	85	40	34
	b. Slope/wall of outer embankment	Good	85	30	25,5
	c. The top of the embankment	Good	85	30	25,5
5	Weir Bridge				
	a. Service and dimensions of the ugly bridge	Poor	30	50	15
	b. Stability for transportation/services	Poor	30	50	15
6	Operation Board				
7	Ruler				
	a. Guess board reading	Good	85	50	42,5
	b. Guessing board installation	Good	85	30	25,5
	c. Reading the flow rate that passes over the weir	Good	85	20	17
8	Safety Fence				
9	Pick Up Doors				
	a. Door operation	Good	85	80	68
	b. Leaf condition	Good	85	20	17
10	Drain Doors				
	a. Door operation	Good	85	80	68
	b. Door leaf condition	Good	85	20	17

a. **Weir Drain Door :**The drain door can operate properly and smoothly. The condition of the door leaf has a slight leak from the wooden beam, the door handlebar is installed in good condition, no damage was found. Lifting equipment (morheis) sill, steel spooring is in good condition and can be operated.

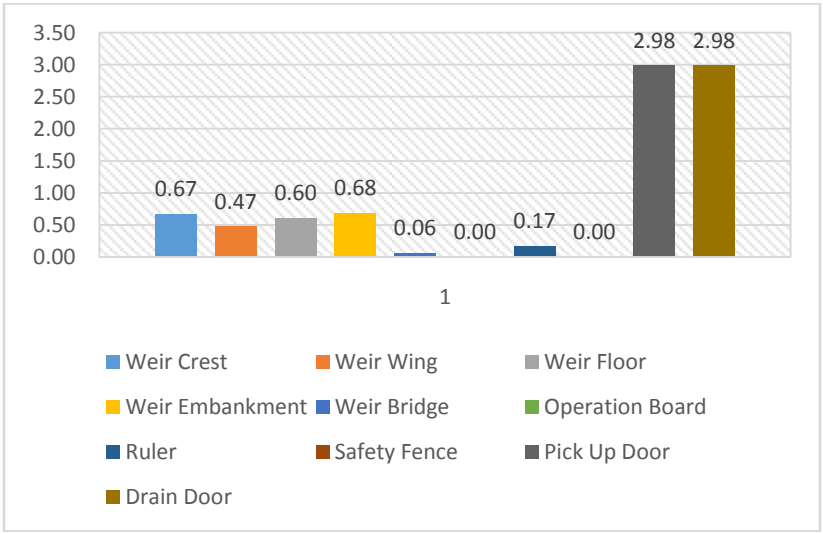

Figure 5:Hystogram calculation of building parameter in DI Jegong

IV. Conclusion

From the evaluation results of the irrigation network performance assessment in the Jegong irrigation area in Suren Village, Ledokombo District, Jember Regency, it can be concluded that: the results of the combined performance assessment (IKSI) of 6 indicators get a combined performance index value of 61.88% while the results of the performance assessment (IKSI)) a combination of the 6 indicators of the Jegong irrigation area according to the PUPR Ministerial Regulation No.12/PRT/M/2015 the combined index value for DI.Jegong entered the assessment criteria 3 with a weight value of 55 – 69 (less performance and needs attention). According to the criteria for the condition of physical infrastructure, the combined performance assessment index value is in the moderate condition category (60% - 80%) which means that the irrigation network in the Jegong irrigation area requires periodic maintenance that is repair. The actual operational and maintenance needs (AKNOP) for the planned budget for repairs to the Jegong irrigation network is IDR. 629,415,000.00 (Six Hundred Twenty Nine Million Four Hundred Fifteen Thousand Rupiah). Meanwhile, the cost of maintaining the irrigation network in the form of routine maintenance of sluice gates for a year is IDR. 17,293,000.00 (Seventeen Million Two Hundred and Ninety Three Thousand Rupiah).

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