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# Asset Management and Performance of Information System-Based Irrigation System

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**KEYWORDS**
Cabak Irrigation; ePAKSI; assets; Performance

**ABSTRACT**
The purpose of this study is to determine the process of data inputted and analyzed through the ePAKSI application, In this thesis used primary and secondary data collection methods. Secondary data as a support for primary data were obtained from the Office of the Public Works and Spatial Planning Office of Temanggung Regency and from the Office of the Food Security, Agriculture and Fisheries Office of Temanggung Regency. The results showed that the data inputted and analyzed with the ePAKSI application included data on asset types, asset names, nomenclature, dimensions and conditions ranging from assets upstream (weir) to downstream (end of the channel) of the Cabak irrigation network and the latest number of assets from field searches in the form of 3 channels, 34 buildings and 14 tertiary plots were known. The results of the evaluation of the performance assessment of the irrigation system of the Cabak Irrigation Area with the ePAKSI application obtained a total value of 63.70% in the less category (55% - 70%) with recommendations for handling needs attention from the Temanggung Regency Government. The details of the evaluation results of the performance assessment of the irrigation system of the Cabak Irrigation Area consist of physical infrastructure with a score of 59.81%, planting productivity 87.84%, supporting facilities 68.00%, personnel organization 71.20%, documentation 62.50% and water user farmer associations (GP3A / IP3A) 30.00%.



## 1. Introduction

Cabak Irrigation Area is one of 577 Irrigation Areas in Temanggung Regency located in Jampiroso Village and Jampirejo Village, Temanggung District, Temanggung Regency with a service area of 58.22 Ha according to PUPR Regulation Data Number 14/PRT/ M/2015. The Cabak Irrigation Area has also never been thoroughly assessed the condition of irrigation assets so that the implementation of irrigation operations and maintenance has not been carried out properly due to

the number of Irrigation Departments under the authority of the Temanggung Regency Government as many as 577 Irrigation Departments and limited human resources in irrigation management in Temanggung (Nugroho, Prayogo, & Wicaksono, 2021); (Rais & Purnomo, 2020). Therefore, a computerized system is needed as a supporting means of assessing assets and irrigation system performance in the Cabak Irrigation Area through the ePAKSI application (Ananda, Rachman, & Tarigan, 2019); (Nur, 2022).

Tracing irrigation assets using the ePAKSI application to obtain data on the current condition of irrigation assets from an Irrigation Area in each irrigation area in the context of irrigation system sustainability, and also to obtain data on the number, specifications, conditions and supporting functions of irrigation management (Fachrie, Samsuar, & Achmad, 2019); (Feriska, 2019).

The ePAKSI information system includes an android-based ePAKSI survey application that will be used to take inventory survey data, damage assessment and performance of irrigation assets through filling out survey forms on smartphones and a web-based ePAKSI survey application that processes field survey data collected through the android-based ePAKSI application (Nugraha, Wahyuni, & Prayogo, 2020); (Putri, Harisuseno, & Purwati, 2015). The ePAKSI web application develops features intended for policy makers to get input on the problems faced so as to support the making of a policy or decision (Syahrul & Musfira, 2021).

The purpose of this study is to conduct a comprehensive assessment of the condition of irrigation assets in the Cabak Irrigation Area using the ePAKSI application as a tool, as well as to improve the effectiveness and efficiency of irrigation operations and maintenance in the region. The benefits of this research include the collection of accurate and comprehensive data on the condition of irrigation assets, their specifications, and supporting functions, which can be used to support the sustainability of irrigation systems. In addition, the implementation of the ePAKSI application is expected to improve the ability of human resource management in the field of irrigation in Temanggung Regency. Thus, this research can make a significant contribution in improving the efficiency of irrigation system management and policy-related decision making in the development and maintenance of irrigation infrastructure.

## 2. Materials and Methods

This research includes inventory of irrigation assets, assessment of the condition and function of irrigation assets and assessment of irrigation system performance index in Cabak Irrigation Area, Temanggung Regency through field searches using the ePAKSI application (Saputra & Qurniawan, 2021). Cabak Irrigation Area is an Irrigation Area under the authority of Temanggung Regency with a service area of 58.22 Ha in accordance with data in the annex to the Regulation of the Minister of Public Works and Public Housing number 14 / PRT / M / 2015 concerning Criteria and Determination of Irrigation Area Status. The Cabak Irrigation Area is located in Temanggung District which includes Jampiroso Village and Jampirejo Village.

The assessment of irrigation system performance on this aspect of physical infrastructure conditions is influenced by the average condition and weight of the assessment. The formula for calculating the condition of irrigation buildings = average condition x assessment weight.

Where:

a. The average condition is obtained from direct observation in the field
b. Appraisal weights are assigned according to the influence of performance appraisal indicators

Assessment of the performance of the irrigation network is carried out on each part of the building, then after calculating each part of the irrigation building then added to get the sum of the overall building condition index values. Next, calculate the weight of each index of the irrigation building section with the formula:

Weight = (Existing condition index/100) x Maximum condition index

Furthermore, after knowing the weight of each irrigation building, then add it all up. After getting the weight of the condition of the building, then calculate the condition of the water building with the formula: Water Building Condition (%) = (Total weights/Maximum condition index) x 100%.

## 3. Result and Discussion

### Input and Analysis of ePAKSI Data for Cabak Irrigation Area

Input and Analysis of ePAKSI Data for Cabak Irrigation Areas is divided into two parts, namely input activities and analysis of ePAKSI data for irrigation asset inventory surveys (PAI) and input activities and analysis of ePAKSI data for irrigation system performance assessment surveys (IKSI) (Winardi, Azmeri, & Masimin, 2020).

### 1) Input and analysis of ePAKSI data for irrigation asset inventory survey

Irrigation Asset Management (PAI) data input on the ePAKSI Android application is divided into 2 parts, namely PAI input for irrigation network assets and PAI input for non-irrigation network assets (Jannata, Abdullah, & Priyati, 2015). PAI inputs for irrigation network assets in the ePAKSI Android application include asset inputs of retrieval buildings, regulatory buildings, auxiliary buildings and carrier channels. This data input starts by selecting the type of irrigation network building asset on the tab in the ePAKSI android application, then filling in data such as the name of the irrigation network building, nomenclature, dimensions and photos (Sari, Anwar, & Sidharti, 2019). PAI inputs for non-irrigation network assets in the ePAKSI Android application include tertiary, office and warehouse plot asset inputs. This data input starts by selecting the type of non-irrigation network asset on the tab in the ePAKSI android application, then filling in data such as the name of the non-irrigation network asset, nomenclature, ownership and photo.

Examples of data input and analysis of irrigation assets in retrieval building assets using the ePAKSI android application include:

a. Asset type = fixed weir
b. Weir name = Cabak weir
c. Nomenclature = Bd. Cb. 01
d. Weir height = 3 m
e. Weir width = 10 m
f. Mercu type = Ogee
g. Weir body material = masonry
h. Olak pool type = USBR type iii
i. Number of left drain holes = 1 piece
j. Left drain door material = iron
k. Power used on drain door = manual
l. Length of drain door = 1 m
m. Dewatering door height = 3 m
n. Number of left intake door holes = 1 piece

o. Left intake door material = iron
p. Power used on the left intake door = manual
q. Left intake door length = 0.7 m
r. Left intake door height = 3 m
s. Service area = 58.22 Ha
t. Water discharge = 0.075 $m^3/s$

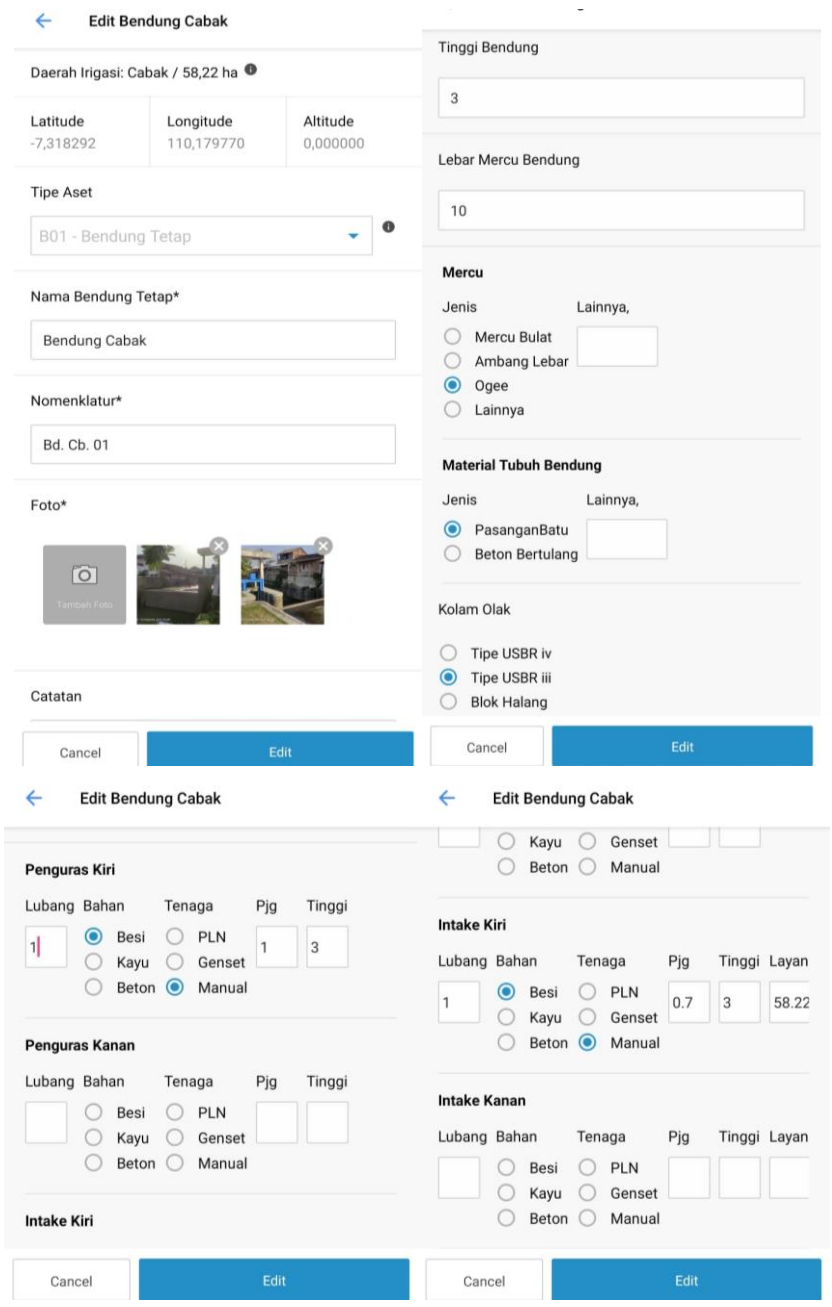


**Figure 2. Input PAI Data on Retrieval Building Assets**

Based on the results of input and analysis of ePAKSI data for the inventory survey of irrigation assets in the Cabak Irrigation Area, it is known that the number of assets for the current Cabak Irrigation Area consists of 3 channels, 34 buildings and 14 tertiary plots. Details for the 3 channels consist of 2 primary channels (primary channel 01 length 1,366 m and primary channel 02 length 1,348 m) and 1 secondary channel length 955 m. Of the 34 buildings consisting of 1 fixed weir building, 4 culvert buildings, 9 waterfall buildings, 1 side spillway building, 14 oncoran buildings, 1 UPTD office building, 1 UPTD warehouse building, 1 tapping building, 1 meeting building and 1 end of the channel.

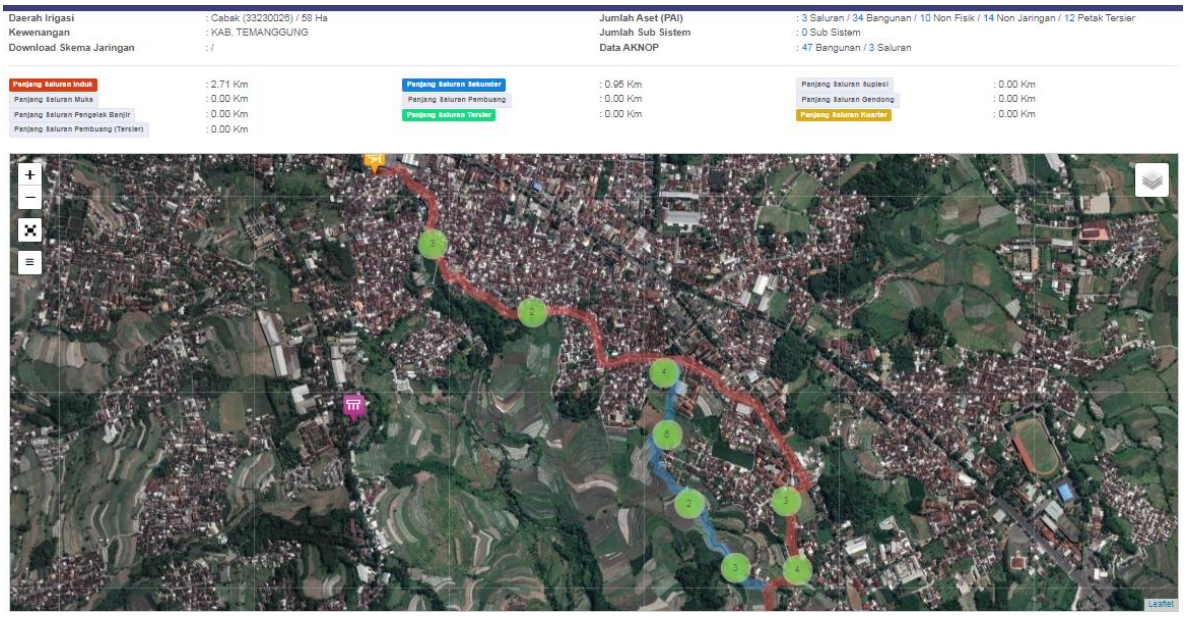


**Figure 3. Results of Input and Analysis of Irrigation Asset Inventory Survey Data**

**2) Input and analysis of ePAKSI data for Irrigation System Performance Index (IKSI)**

Input of Irrigation System Performance Index (IKSI) data is carried out after the Irrigation Asset Management (PAI) survey activities are completed (Malik, Musa, & Ashad, 2022). Filling in this data is done by tapping on the asset map object using the ePAKSI Android application starting from upstream (weir) to downstream (end of the channel) of the Cabak irrigation network in accordance with the results of input and analysis of irrigation asset management (PAI) data. Input the Irrigation System Performance Index (IKSI) data by assessing the condition of each building and channel according to conditions in the field on the form in the PAKSI Android application (Umum, 2019a); (Sebastian, Dermawan, & Sisinggih, 2021). Input performance appraisal data is recorded on the assessment form in the ePAKSI application with available assessment categories consisting of very good, good, medium and bad conditions (Tahadjuddin, 2018). Category guidance has been provided on the ePAKSI assessment form as technical assessment instructions to make it easier to assess the condition of the asset (Umum, 2019b). Each asset assessed consists of several technical assessment indicators that must be assessed so that the performance of the Cabak irrigation network can be known thoroughly for its physical infrastructure aspects. Irrigation performance assessment on irrigation network assets includes the following:

**Assessment of the Condition of the Picking Building**

**Table 1. Results of Assessment of the Condition of the Picking Building**

| No. | Description | Condition value |
|---|---|---|
| 1 | Mercu Weir | 92% |
| 2 | Weir Wing | 92% |
| 3 | Weir Floor | 85% |
| 4 | Upstream and Downstream Cover Embankments | 85% |
| 5 | Bridges (on weir/service) | 95% |
| 6 | Operating Board | 0% |
| 7 | Measuring Bar | 0% |
| 8 | Safety Fence | 0% |
| 9 | Intake Door | 85% |
| 10 | Weir Dewatering Door | 85% |

The results of the assessment of the condition of each part of the retrieval building were then calculated and the results obtained in the retrieval building amounted to 10.35% of the maximum total 13% that could be obtained. This is due to the absence of operating boards, measuring bars and safety fences on weir buildings so that it affects the existing final value. Here is an example assessment for a landmark building on a weir.

**Table 2. Results of the Assessment of the Condition of the Dam Mercu**

| Mercu | Condition | Value | Influence Weight (%) | Final Grades |
|---|---|---|---|---|
| 1. Mercu and weir body | Very good | 95 | 60 | 57 |
| 2. Leaks | Good | 85 | 10 | 8,5 |
| 3. Surface coating | Very good | 95 | 10 | 9,5 |
| 4. Pillar on drain door | Good | 85 | 20 | 17 |

The assessment of the condition of the landmark building and the body of the Cabak weir is in good condition, intact and there is no decrease in elevation in the assessment of very good condition. Leak assessment only has a small leak or water seepage in the assessment of good condition. The assessment of the surface layer of the landmark is less than 10% of the peeling part of the surface of the landmark in the assessment of excellent condition. The assessment of the pillars on the draining door of the condition has cracks of no more than 20% in the assessment of good condition. Furthermore, from the 4 (four) assessments of the condition of the weir is multiplied by each influence weight and the final value is added = 57% + 8.5% + 9.5% + 17% = 92% (90 – 100%) is categorized as very good condition.

**Carrier Channel Assessment**

**Table 3. Carrier Channel Condition Assessment Results**

| No. | Description | Condition value |
|---|---|---|
| **Primary Channel 01 Length 1,366 m** | | |
| 1 | Channel capacity carrying discharge needs | 77,74% |
| 2 | The height of the embankment against overflow during operation | 79,12% |
| 3 | Implementation of repairs or maintenance | 83,38% |
| **Primary Channel 02 Length 1,348 m** | | |
| 1 | Channel capacity carrying discharge needs | 77,34% |
| 2 | The height of the embankment against overflow during operation | 77,36% |
| 3 | Implementation of repairs or maintenance | 79,60% |
| **Secondary Channel 01 Length 955 m** | | |
| 1 | Channel capacity carrying discharge needs | 54,00% |
| 2 | The height of the embankment against overflow during operation | 48,86% |
| 3 | Implementation of repairs or maintenance | 62,38% |

The results of the assessment of the condition of each part of the carrier channel are then calculated and results are obtained on the carrier channel, which is 7.15% of the maximum 10% total that can be obtained. This is because the value of secondary channel 01 on the carrier channel is low and is included in the category of bad conditions so that it affects the final value.

**Building Assessment on Carrier Channels**

**Table 4. Carrier Channel Condition Assessment Results**

| No. | Description | Condition value |
|---|---|---|
| 1 | Regulatory Building | 37,50% |
| 2 | Discharge measurement can be done according to the DI operation plan | 0% |
| 3 | Functional and complete auxiliary buildings | 61,01% |
| 4 | All building repairs on the carrier line have been completed | 32,72% |

The results of the assessment of the condition of each part of the building in the carrier channel were then calculated and obtained the results of the building in the carrier channel, which was 2.79% of the maximum 9% total that could be obtained. This is because discharge measurement can be carried out according to the non-existent DI operation plan and the value of regulatory buildings and the value of building repairs in the carrier channel are categorized as bad so that they affect the existing final value.

**Assessment of Sewer Ducts and Their Buildings**

The assessment result of the sewer and building is 0% of the maximum total 4% that can be obtained**.** This is because the Cabak Irrigation Area does not have a sewer that has been built and is listed in the maintenance list and there is no flood problem.

**Driveway/Inspection**

The result of the driveway/inspection assessment is 3.24% of the maximum total 4% that can be obtained. Driveway/inspection assessments include driveways to the main building in good condition, inspection roads and walkways along repaired channels and the percentage of the number of buildings and channels that are easily accessible.

**Office, Housing and Warehouse**

**Table 5. Office, Housing and Warehouse**

| No. | Description | Condition value |
|---|---|---|
| 1 | Office | 85% |
| 2 | Housing | 0% |
| 3 | Warehouse | 85% |

The results of the assessment of the condition of each part of the office, housing and warehouse are then calculated and obtained results in offices, housing and warehouses, which is 3.40% of the maximum 5% total that can be obtained. This is because there is no housing for orderlies so that it affects the existing final value.

Based on the results of input and analysis of ePAKSI data for the assessment of the Irrigation System Performance Index (IKSI) in the Cabak Irrigation Area in each part of the physical infrastructure aspect after summing and obtaining the final results of the assessment of the physical infrastructure components of the Cabak Irrigation Area amounting to 26.92% of the maximum 45% total that can be obtained (Musa, 2021). This is because the assessment of the sewer channel and the building of the Cabak Irrigation Area does not exist so that it affects the final value that exists.

**Evaluation Results of Cabak Irrigation System Performance Assessment**

The results of the irrigation system performance evaluation assessment for the Cabak Irrigation Area are in the form of irrigation system performance assessment results consisting of 6 (six) assessment components, namely:

**1. Physical infrastructure**

Based on the results of ePAKSI data processing on the physical infrastructure component, a performance assessment score of 59.81% was obtained in the poor category with recommendations for handling in the form of system replacement or rehabilitation. This result is obtained from the final weight of the physical infrastructure component of 26.92% divided by the maximum weight of the physical infrastructure component of 45.00%, then multiplied by 100% so that the performance appraisal score on the physical infrastructure component is 59.81%. The final weight of physical infrastructure of 26.92% consists of the weight of the main building of 10.35% of a maximum of 13.00%, the weight of the carrying channel of 7.15% of the maximum 10.00%, the weight of the building on the carrier channel of 2.79% of the maximum 9.00%, the weight of the sewer and the building is 0% of the maximum 4.00% because it does not have a sewer, the weight of the entrance/inspection is 3.24% of the maximum 4.00% and the weight of the office, housing and warehouses amounted to 3.40% from a maximum of 5%.

**2. Plant productivity**

Based on the results of processing ePAKSI data on the planting productivity component, a performance assessment score of 87.84% was obtained in the good category with handling

recommendations to be maintained. This result is obtained from the final weight of the planting productivity component of 13.18% divided by the maximum weight of the planting productivity component of 15.00%, then multiplied by 100% so that you find a performance assessment score on the planting productivity component of 87.84%. The final weight of planting productivity of 13.18% consists of the weight of meeting water needs (factor K) of 9.00% from a maximum of 9.00%, the weight of planting area realization of 2.18% from a maximum of 4.00% and rice productivity of 2.00% from a maximum of 2.00%. The K-factor value, planting area realization and rice yield all have an impact on how productive an assessed planting is.

**3. Supporting facilities**

Based on the results of ePAKSI data processing on supporting facilities components, a performance appraisal score of 68.00% was obtained in the medium category with handling recommendations in the form of improvements and additional facilities. This result is obtained from the final weight of the supporting facilities component of 6.80% divided by the maximum weight of the supporting facilities component of 10.00%, then multiplied by 100% so that the performance appraisal score on the supporting facilities component is 68.00%. The final weight of supporting facilities of 6.80% consists of the weight of irrigation operation and maintenance equipment of 2.80% of a maximum of 4.00%, the weight of transportation equipment of 1.20% of a maximum of 2.00%, the weight of observer office equipment / UPTD of 1.40% of a maximum of 2.00% and communication equipment of 1.40% of a maximum of 2.00%.

**4. Personnel organization**

Based on the results of ePAKSI data processing in the personnel organization component, a performance appraisal score of 71.20% was obtained in the medium category with handling recommendations in the form of additional personnel and capacity building. This result is obtained from the final weight of the personnel organization component of 10.68% divided by the maximum weight of the personnel organization component of 15.00%, then multiplied by 100% so that you find a performance appraisal score in the personnel organization component of 71.20%. The final weight of the personnel organization of 10.68% consists of the weight of the operation and maintenance organization that has been prepared with clear limits of responsibilities and duties of 3.50% of a maximum of 5.00% and personnel of 7.18% of a maximum of 10.00%.

**5. Documentation**

Based on the results of ePAKSI data processing in the documentation component, a performance appraisal score of 62.50% was obtained in the medium category with recommendations for handling to be equipped with documentation. This result is obtained from the final weight of the documentation component of 3.13% divided by the maximum weight of the documentation component of 5.00%, then multiplied by 100% so that the performance appraisal score on the documentation component is 62.50%. The final weight of documentation of 3.13% consists of the weight of the completeness of the Irrigation Area data book of 1.55% from a maximum of 2.00% and the weight of the completeness of maps and drawings of 1.58% from a maximum of 3.00%.

**6. Institutional P3A/GP3A/IP3A**

Based on the results of ePAKSI data processing on the components of the water user farmer association (GP3A / IP3A), a performance assessment score of 30.00% was obtained in the bad category with recommendations for handling comprehensive assistance. This result is obtained from the final weight of the components of the water user farmer association (GP3A / IP3A) of 3.00%

divided by the maximum weight of the supporting facilities component of 10.00%, then multiplied by 100% so that the performance assessment score on the component of the water user farmer association (GP3A / IP3A) is 30.00%. The final weight of the water user farmer association (GP3A/IP3A) of 3.00% consists of the weight of GP3A/IP3A already incorporated by 0.45% of a maximum of 1.50%, the weight of GP3A/IP3A institutional conditions of 0.15% of a maximum of 0.50%, the weight of GP3A/IP3A meetings with branches/observers/UPTD of 0.60% of a maximum of 2.00%, the weight of GP3A/IP3A actively participating in network surveys/searches is 0.30% from a maximum of 1.00%, GP3A/IP3A participation weight in network repair and natural disaster management is 0.60% from a maximum of 2.00%, GP3A/IP3A contribution weight is used for tertiary network repair of 0.60% from a maximum of 2.00% and GP3A/IP3A participation in planting planning and water allocation is 0.30% from a maximum of 1.00%.

The recapitulation of the calculation of the irrigation system performance index in table 4.4.1 for the Cabak Irrigation Area obtained a value of 63.70% from a maximum of 100.00% in the less category (55.00% - 70.00%) with recommendations for handling needs attention. The following is a resume table of the evaluation results of the Cabak irrigation system performance index assessment.

**Table 6. Resume of Cabak irrigation system performance appraisal evaluation results**

| No. | Component | Score | Category | Recommendations |
|---|---|---|---|---|
| 1. | Physical Infrastructure | 59,81 | Ugly | System Replacement/Rehab |
| 2. | Planting Productivity | 87,84 | Good | Maintained |
| 3. | Supporting Facilities | 68,00 | Keep | Repair & Addition of Facilities |
| 4. | Personnel Organization | 71,20 | Keep | Personnel Addition & Capacity Building |
| 5. | Documentation | 62,50 | Keep | Need to be equipped |
| 6. | Institutional P3A/GP3A | 30,00 | Ugly | Comprehensive Mentoring |
| Irrigation System Performance | | 63,70 | Less | Need Attention |

## 4. Conclusion

From the results of research on asset management and performance of information system-based irrigation systems (ePAKSI), the case study of the Cabak Irrigation Area of Temanggung Regency found several conclusions that can be drawn. The data inputted and analyzed with the ePAKSI application includes data on asset type, asset name, nomenclature, dimensions and conditions ranging from assets upstream (weir) to downstream (end of channel) of the Cabak irrigation network. The results of network tracing in the field with the ePAKSI application in the Cabak Irrigation Area revealed the latest number of assets in the form of 3 channels, 34 buildings and 14 tertiary plots. The results of the evaluation of the performance assessment of the irrigation system of the Cabak Irrigation Area obtained a value of 63.70% in the category of less (55% - 70%) with performance details consisting of physical infrastructure with a score of 59.81%, planting productivity 87.84%, supporting facilities 68.00%, personnel organization 71.20%, documentation 62.50% and water user farmer associations (GP3A / IP3A) 30.00%.

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