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Research Paper

The Effectiveness of Irrigation Network System Management To Agricultural Pattern By Analytical Hierarchy Process Method In Pasuruan Regency, East Java Province

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ABSTRACT : *Irrigation Network System management is necessary and mandatory activities since irrigation network acted as the main component for supporting harvest productivity especially for type of plants grow in agriculture fields. There are many irrigation network systems experiencing declining function, in particular in the main canal which resulted water shortages or insufficient water volume for the agricultural land, or in other irrigation buildings in rivers such as canal, turning gate of the divider building, or in the spillway channels which made water supply from the upstream part of the river works less optimal to reach the downstream part of the river where particularly lies the agriculture farms. Hence, the irrigation network system must be constructed as optimal as possible to make these sets of buildings able to provide maximum water supply. In overcoming problem which might occurred, the authors selected a measurement system using a priority scale called the Analytical Hierarchy Process with expectation that this method able to determine the highest value as the priority scale to be a benchmark for making improvement to the irrigation building system that underwent damages, like damages in the main building such as bent doors, gutters, siphons and damaged wall stones and others. By applying the Analytical Hierarchy Process, there are four criteria can be chosen ranging from light damage, moderate damage, heavy damage, also length of the damage. Whereas for criteria determination, there are 3 sub-criteria existing namely primary canal, secondary canal, and tertiary canal located in five villages in Pasuruan Regency (Kedung Pengaron, Kepuh, Lorokan, Tanggulangin, and Randugong villages).*
Result analysis of this research had succeeded in creating the priority scale for repairing the damage in irrigation buildings. The priority scale started with Kepuh village as the first priority (with the highest value of 0.195) and followed by Tanggulangin village as the second priority (with a weight value of 0.112), Randugong village as the third priority (with a weight value of 0.107), Lorokan village as the fourth priority (with a weight value of 0.097) and Kedungperon village as the fifth priority (with a weight value of 0.054) interpreted as the village who experiencing the least damage in its irrigation network system.
KEYWORDS: *Pasuruan Regency, Effectiveness, Irrigation Network System, Analytical Hierarchy Process, Farming Plant Pattern*

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I. INTRODUCTION

Pasuruan Regency acted as one of many contributors to regional food stock, so irrigation development to support the agricultural sector becomes mandatory since most irrigation network system (buildings and canals) experienced declining function from damages of the main buildings (dam, spillway gates and other irrigation buildings) that require repair and rehabilitation activities, to make the building and irrigation canals get normal function for operation. There are several efforts need to be made to repair the damaged irrigation building in order to maintain and increase the productivity of food self-sufficiency. Moreover, repair or make improvement to irrigation buildings can maximize the ability to provide optimal water supply for producing high-intensity food crops such as rice and the other secondary crops. Operational and maintenance also improvement activities to buildings and irrigation channels must be carried out to intensify the smoothness flow of river water in the primary, secondary and tertiary canals for irrigation of agriculture farms in Krikilan area where the rice and secondary crops are planted for achieving several purposes such as strengthening food self-sufficiency condition, increasing the economic growth of the area, raising the farmers' income, also optimizing the use of water resources. These aims can be attained with efforts of improvement to performance of irrigation system, in particular restoring function of the existing irrigation network system for reducing greater loss of water and facilitates equal water distribution for intensifying planting activities as well as supporting better productivity of rice and secondary crops farming. Thus, to achieve the above objectives, it is necessary to operate and maintain the canals and ditches within the irrigation network buildings located at Krikilan irrigation area, Kejayan District of Pasuruan Regency.

By an analysis to the effectivity of irrigation network system in Krikilan irrigation area, the expectation is able to provide input for related agencies since these activities are always related to the work performance process of irrigation network which inseparable from supervision activity. Operational activity of irrigation network able to support the work performance of other irrigation buildings since this activity plays as the focal point in the irrigation network system, also providing guidance to local farmers in the village.

In so far, any discussions related to effectivity of irrigation network system management to agricultural planting pattern as viewed by method of Analytic Hierarchy Process have not been carried out by many researchers, therefore the problems raised in this study are (1) what acts must be taken to ensure the water management system that regulates and distributes water supplies runs effectively with a good periodical time to the agriculture farms in the Krikilan irrigation area?, (2) what should be done to upgrade the effectivity of the irrigational canal management?, (3) how to determine the priority scale in the improvement plan of irrigation canal sector so the rehabilitation work can be carried out in regular schedule?

II. LITERATURE REVIEW

2.1. Previous Researches

Review of previous researches aimed to obtain a comparison and reference materials. Apart from that, it is conducted to avoid assumption of similarity to this research. In this literature review, the researchers include result from several previous researches as follows:

2.1.1. The research result of Ansori, et al. (2013) [1]

By a research title of "The Study of Effectiveness and Efficiency of Irrigation Networks on Water Adequacy for Rice Plants (A Case Study in Kaiti Samo Irrigation, District of Rambah, Rokan Hulu Regency), this research aims to analyze the efficiency of existing irrigation channels in Kaiti Samo Irrigation Area, Rokan Hulu Regency. Result calculation of this research in relation to the efficiency of Kaiti Samo irrigation canal were stated as: the primary canal efficiency was 84.51 %, the secondary canal efficiency was 76.29% and the tertiary canal efficiency was 73.04 %. Based on efficiency found in the Kaiti Samo irrigation canal, the overall water distribution efficiency was stated in percentage of 47.09%, a value that in accordance to the statement of Directorate General of Irrigation (1989) defines the overall water distribution efficiency classified as in a good condition.

2.1.2. The research result of Romdani, et al. (2017) [2]

By a research title of "Analysis of the Effectiveness of Irrigation System Management in Panunggal Irrigation Area of Tasikmalaya City", this research aims to analyze effectiveness of irrigation system in Panunggal Irrigation area of Tasikmalaya city with conclusion as result of research said that the water availability in Panunggal area irrigation network has water discharge of 1,625 m3/sec. Meanwhile, the water necessity for irrigating the Panunggal area with length of 9.62 ha that has rice planting pattern starting from November as the beginning of land processing has a maximum irrigation water necessities of 0.021 m3/sec. These values showed water discharge for water availability was greater than water discharge for irrigation necessities, therefore, the water demand in the Panunggal area can be met.

2.1.3. The research result of Sururi (2017) [3]

By a research title of "Effectivity of Maintenance Program Implementation to Irrigation Network Infrastructure in Lebak Regency", this research aims to seek result of the effectiveness of implementation of maintenance program to the irrigation network infrastructure in Lebak Regency as approached by descriptive research through a quantitative method; research that held to describe the extent of effectiveness of implementation of infrastructure maintenance program in Lebak Regency. The study population was all employees in the Human Resources Department at Public Works and Spatial Planning Agency (*Dinas Pekerjaan Umum dan Penataan Ruang abbreviated as PUPR*) also employees from UPTD Region V in Lebak Regency with total amount of respondents were 59 individuals. The research data then tabulated with data analysis technique of validity and reliability tests (Statistical Program Social Sciences/SPSS software version 22).

2.2. The Definition of Irrigation

As explained by Mawardi and Memed in Hidayat, irrigation derives from a Dutch term of "irrigatie" or "irrigation" in English as the efforts to obtain water from a source for agricultural or farming purpose, to channel and distribute water regularly where after the water use finished, the water can be redisposed [1]. Meanwhile, according to regulation of Minister of Public Works and Public Housing number 12/PRT/M/2015, irrigation is the work of providing, regulating and disposing irrigation water to support the agriculture farm which categorizes into several types of irrigations (surface, swamp, underground water, pumps and ponds irrigations) [4]. Moreover, the ministerial decree No.32-year 2007 as quoted in Wiryawan et.al stated that irrigation is any provision, arrangement and disposal activities of irrigation water to support agriculture sector which classified into surface, swamps, underground water, pumps and ponds irrigations [5]. In line with these definitions, Kartasaputra in Ansori et al., stated that irrigation is an artificial manmade effort to increase soil water shortages by providing water in a systematical way to the cultivated land. The amount of water necessity for irrigation to support crop growth depends on how much the water usage (level of water necessity) and the efficiency of the existing irrigation network. The irrigation network is classified into three levels when viewed from the way of the network is regulated and the way of measurement of the water flow and facilities; (a) simple irrigation network, (b) semi-technical irrigation network and (c) technical irrigation networks [1].

2.3. The Irrigation Network

According to Malik, et.al, irrigation network is the canals, buildings and complementary buildings which works as a unit [6]. Meanwhile, Zettyara & Safitri (2022) define irrigation networks as an important factor that has direct impact to the quality and quantity of crops [7]. Effectivity of irrigation network is a form of irrigation network system seen from buildings and irrigation canals that able to perform a normal function or not to make the flowing water run in effective way. To assess whether effective or not effective, it can be seen from the main building condition and from the established buildings such as the dam, primary canal, secondary canal, culverts, building condition for the intake building, the separate-intake building, the tertiary box located in the middle of rice farms, gates, along with other related buildings. When these buildings experience damages then water supply cannot flow in normal way because parts of buildings unable to work in proper function, so the work performance from the irrigation network system will be less effective.

Irrigation activities are the provision and regulation of the water for irrigating agriculture farms whereas the management of water irrigation are dividing, distributing and using the irrigation water for the agricultural purpose. Hence, control buildings become the main infrastructure to carry out these activities and type of control buildings which will be discussed in this article are divider building, intake building, and divider-intake building.

2.4. The Function of Irrigation

According to Anna et al., irrigation functions to support agricultural productivity for ensuring the national food security status and community welfare (in particular for the farmers) is fulfilled [8]. Moreover, another function of irrigation aside from water distribution are as follows:

1. Wetting soil; as one crucial goal since plants need plentiful of water during the growth period. Wetting the soil aims to fulfill the water shortages when the rainwater rate is low.
2. Mulching the soil or spreading fertilizers or wetting the soil with water river that rich of mineral contents.
3. Setting the soil temperature into optimal temperature for ensuring the plants able to grow well. Water irrigation able to help the plants to reach the optimum temperature.
4. Cleanse the land from unwanted plant pests such as snake, mice, insects and others. Aside from that, water irrigation able to dispose unwanted substances for the plants into the waste ducts.
5. Increase the ground water availability since the surface of ground water will rise when it flooded by the water from irrigation system. With a higher ground water level, then the river discharge during dry season will increase automatically.

2.5. Carrier Ducts/Distribution Canals

According to Susetyaningsih & Permana, a carrier duct or distribution canal is a part of irrigation infrastructure functions to channel water into rice farms through the intake door. Before the water flows through the primary canal, the captured water taken by the intake gate flows through the mud bag where it will capture sedimentation before it flows through the primary canal, thus, by mud bags installment, the amount of sedimentation carried into the canals can be minimized. Furthermore, the distribution canal is an irrigation infrastructure with function for taking water from water sources, carrying or channeling water from sources to the agricultural land, distributing water to plants, also regulating and measuring the water flow [9]. As described further by Parasu that dividing the carrier ducts/distribution canals into several types of [10]:

1. Primary Canal/Main Duct.

Primary canal is the channel that carrying water from the main irrigation building to secondary canal/ secondary duct and to irrigated farm patches.

2. Secondary Canal/Secondary Duct.
   Secondary canal or secondary duct is a channel that carrying water from the primary canal to the farm patches served by the secondary canal. The route of secondary canal starts from the intake building in the primary canal and ends at the last intake building in the secondary canal.
3. Tertiary Canal/Tertiary Duct.
   Tertiary canal or tertiary duct is the channel that carrying water from tertiary intake building located in the primary and secondary canals and distributing it to quarterly canal and to tertiary farm patches that it served. This canal starts from the tertiary intake building and ends at the last quarter box.
4. Quarterly Canal/Quarterly Duct
   The quarterly canal or quarterly duct is a channel that carrying water from the quarter box to the irrigated farm patches.

III. RESEARCH METHOD

3.1. Definition of Analytical Hierarchy Process (AHP)

According to Saaty in Jolang & Sumbawati (2019), meaning of Analytic Hierarchy Process is abstracting the structure of a system to study its functional relationships between components and their consequences on the system as a whole. This system basically is designed to rationalize the collected perceptions of people that closely related to certain problems through a procedure until arrives at a preference scale among various alternatives. [11]

AHP is aimed for creating a problem model which does not have a solid structure, usually is set to solve measurable (quantitative) problem, or problems that require opinion (judgments) or situation which has a complex or unframed nature or in situation where data and statistical information are presented in a very minimal set or not available at all. So, this system is only qualitative in nature and based on perception, experience or intuition.

Analytical Hierarchy Process is a general theory of measurement with four types of usable measurement scales; nominal, ordinal, interval and ratio scales. A higher scale can be assigned or categorized into a lower scale, but not in vice versa. For example, a monthly income on a ratio scale can be categorized into income level on an ordinal scale or in categories of high, middle and low on a nominal scale. On the contrary, when data obtained is considered as categorical or ordinal, data on a higher scale cannot be obtained. Analytical Hierarchy Process reliable to overcome some of these problems. Furthermore, Saaty & Vergas also stated that Analytical Hierarchy Process is used for lowering the ratio scale from several pairwise comparisons which has discrete or continuous in nature. The pairwise comparison can be obtained through actual measurement or relative measurement from the degree of preference, importance or feelings. Thus, AHP is reliable to help in getting a ratio scale for things which previously difficult to measure (such as measuring opinions, feelings, behaviors and beliefs. Implementation of Analytical Hierarchy Process begins by creating a hierarchical structure or network of the problem that expected to be researched. In the hierarchy diagram, there are main objectives, criteria, sub-criteria and also alternatives that will be discussed. [12]

3.1.1. Stages of Decision-Making in AHP Process

In general, stages of decision-making process through Analytical Hierarchy Process are stated as follow:

1. Defines the problem and determines the desired solution.
2. Creates a hierarchical structure which started by a general goal, followed by making criteria and alternative choices that wishes to be ranked.
3. Forming a pairwise comparison matrix describing the relative contribution or influence of each element towards each goal or criterion at the next (above) level. Comparison will be made by assessing level of importance from one element when compared to other elements.
4. Normalizing the data by dividing each element value in the matrix that paired with the total value of each column.
5. Calculates eigenvector value and tests its consistency. When the value is inconsistent then data collection (preferences) needs to be repeated. The mentioned eigenvector value is the maximum eigenvector value that obtained through Matlab application method or through a manual calculation.
6. Repeat steps 3, 4, and 5 for all hierarchical levels
7. Calculates eigenvector of each pairwise comparison matrix. The eigenvector value is the weight of each element. This step is taken for synthetizing choices in determining priorities of element located at the bottom of hierarchical level to achieve goals.
8. Testing the hierarchical consistency. When the value does not meet the CR < 0.100, then the research assessment must be repeated.

3.1.2. Basic Principles of Analytical Hierarchy Process (AHP)

For creating a solution to a problem by using the Analytical Hierarchy Process method, there are several basic principles that must be understood, including:

1. Decomposition
   Decomposition is breaking down or dividing a complete problem into elements within a hierarchical form of decision-making process where each element is interconnectable. The decision hierarchy structure has two categories; a complete structure and incomplete structure. A decision hierarchy is called complete decision when all elements at one level have a relationship to all elements at the next level, while an incomplete decision hierarchy is the opposite of a complete hierarchy. The format of decomposition structure is: (a) first level: decision objectives or goal, (b) second level: criteria, (c) third level: alternatives.

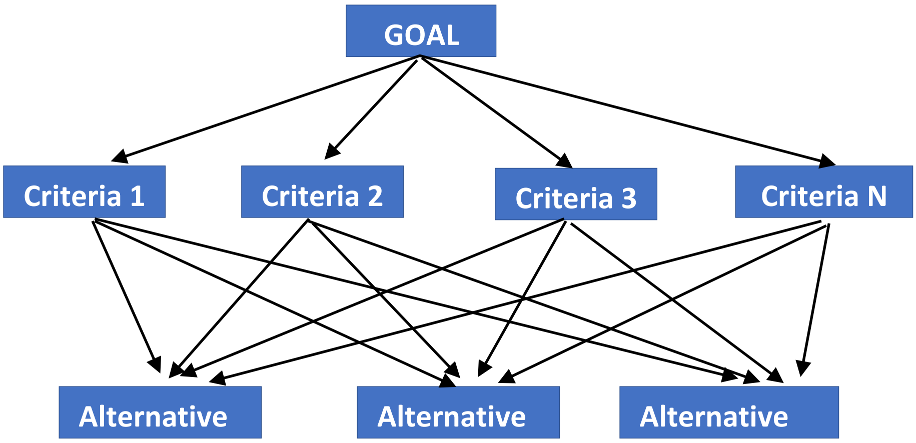

Figure 1: Hierarchy Structure

The problem hierarchy is designed to aid the decision-making process in a system by taking into account all the decision elements involved.

2. Comparative judgment
   Comparative judgment is an assessment made with basis on relative importance of two elements at a certain level in relation to the next (above) level. Comparative judgment is the core of the AHP usage because it will affect priority order of the elements. The result of assessment will be presented in form of a pairwise comparison matrix which contained the preference level of several alternatives for each criterion. The preference scale starts from scale 1 as the lowest level (equal importance) to scale 9 as the highest level (extreme importance).
3. Synthesis of priority
   Synthesis of Priority is conducted by using eigenvector method to obtain the relative weight for elements of decision-making process.
4. Logical consistency
   Logical consistency is carried out by aggressing all eigenvectors obtained from various hierarchical levels and then attaining a weighted composite vector which produces a sequence of decision making.

IV. RESULT AND DISCUSSION

4.1. Analytical Hierarchy Process

4.1.1. Multi Criteria Determination

A decision-making process by using multi-criterion can be done by applying the Analytical Hierarchy Process method. In applying the AHP method, decomposing problem is necessary as conducted in steps of identifying criteria and sub-criteria that will be used. Main criteria in selecting a strategy for the urgency of improvement in the irrigation buildings is the aspect of numbers of damages happened to the irrigation buildings. Analysis to irrigational canal and building rehabilitation by applying AHP method have several hierarchies. The first hierarchy contains objective of priority for optimizing the effectiveness of irrigation buildings in the Krikilan Irrigation area. The second hierarchy contains objective of criteria for determining the criteria for three factors of damage level (light damage, moderate damage, and heavy damage). Meanwhile, each criteria have sub-criteria placed in the third hierarchy, whereas the technical sub-criteria consisted of primary canal, secondary canal and tertiary canal, and the final hierarchy is the ultimate alternative that will be used in the scenario to achieve the optimal priority scale for the irrigation building rehabilitation project.

Table 1. Calculation of Number of Damages in the Irrigation Building

No	Name of Village	Code	Total Damage
1	Kedung Pengaron	A-1	13 spots
2	Kepuh	A-2	30 spots
3	Lorokan	A-3	18 spots
4	Tanggulangin	A-4	22 spots
5	Randugong	A-5	22 spots

Table 2. Calculation of Number of Damages I the Irrigation Building

No	Name of Village	Length of Bendung – Tersier River	Number of Damages		
			Primary Canal	Secondary Canal	Tertiary Canal
1	Kedung Pengaron	2 Km	3 spots	6 spots	4 spots
2	Kepuh	5 Km	7 spots	14 spots	9 spots
3	Lorokan	2.5 Km	5 spots	8 spots	5 spots
4	Tanggulangin	3.7 Km	6 spots	11 spots	5 spots
5	Randugong	4 Km	6 spots	9 spots	7 spots

The pairwise comparison for alternative from basis factor criteria of number of damages in each canal are found at Kedungpengaron, Kepuh, Lorokan, Tanggulangin and Randugong villages. There were differences to number of damages found in each building of the irrigation canals from the studied villages (five villages) caused by factor of evaporative scours of heavy floods coming from various directions of the river which damaging each irrigation building. Then, next identification is assessing the damage level based on the percentage of building damage.

Table 3. The Continuity of Irrigation Building Rehabilitation

NO	CANALS/CHANNELS	CODE	IRRIGATION BUILDING REHABILITATION
1	Kedung Pengaron	A-1	Regular; Annual
2	Kepuh	A-2	Regular; Annual
3	Lorokan	A-3	Regular; Annual
4	Tanggulangin	A-4	Regular; Annual
6	Randugong	A-5	Regular; Annual

Table 4. The Continuity of Irrigation Building Rehabilitation

NO	CANALS/CHANNELS	CODE	PRIMARY CANAL	SECONDARY CANAL	TERTIARY CANAL
1	Kedung Pengaron	A-1	20 Meter	15 Meter	40 Meter
2	Kepuh	A-2	40 Meter	30 Meter	30 Meter
3	Lorokan	A-3	27 Meter	35 meter	35 meter
4	Tanggulangin	A-4	20 Meter	30 meter	20 meter
5	Randugong	A-5	35 Meter	20 meter	25 meter

From data of length and damages in all (five villages) sites, the farthest length was the A-2 point. Distance differences occurred due to land and springs (water source) utilization used by farmers who live around the spring locations and the variety of distances of each spring location to destined service areas or the rice patches that resulted in different values during the weighting matrix process.

Table 5. The Continuity of Irrigation Building Rehabilitation

NO	PARAMETERS	PRIMARY CANAL	SECONDARY CANAL	TERTIARY CANAL	LENGTH OF CANAL
1	Light damage	0,430	0,535	0,450	1,537
2	Moderate damage	0,430	0,820	0,352	1,285
3	Heavy damage	0,565	0,420	0,510	1,550
4	Length of damage	0,415	0,430	0,345	0,958
Amount		**1,840**	**2,205**	**1,657**	**5,330**

The sum values of each parameter will be used to calculate values of priority vector or eigenvalue. Calculation of pairwise comparison matrix value is used to determine the value of priority vector from each parameter. The value of priority vector then will be used to obtain maximum λ value (where calculation of priority vector value is shown in equation 5). The results of priority vector for each parameter which categorized into light damage, moderate damage, heavy damage, also the length of damages is presented in table 6. The next step is using the result of the priority vector to calculate the maximum λ value and obtaining a maximum λ value of 4.121. Then, the maximum λ value is used to calculate the value of consistency. A larger value of maximum λ value can make the final value becomes inconsistent.

The consistency value calculation started by calculating the consistency index (CI) value as the initial stage [10]. The CI value is obtained by using equation 7 with result of 0.040. The results of the CI calculation are used to calculate the consistency ratio (CR) value. Calculation of consistency ratio aims to determine the weighting value and to determine whether the pairwise comparison matrix has consistent or inconsistent value. The CR value is calculated using equation 8 with the obtained result is 0.045 which means the CR value = 0.045 < 0.1, so the value is consistent.

The next stage is calculation of alternative values based on parameters using a pairwise comparison matrix. The pairwise comparison matrix calculation is conducted based on expert assessment to obtain priority vector value. The alternative priority vector is used to calculate final value or the synthesis of Analytical Hierarchy Process model. The calculation result of the parameters to the alternatives are presented in figure 4.2, where it can be explained that values of alternative priority vector are inversely proportional to the values of number of alternatives. Values of parameter priority vector and alternative priority vector are used to calculate the final value of AHP model. The final calculation of the AHP model is carried out by synthesizing all alternative priority vectors to parameter priority vectors. Calculation for synthesis of AHP model is conducted by equation 9 with result presented in table 6 below.

Table 6. The Value of Priority Vector for Each Parameter

PARAMETERS	PRIMARY CANAL	SECONDARY CANAL	TERTIARY CANAL	LENGTH	PRIORITY VECTOR
Light Damage	0,430	0,535	0,450	1,537	0,445
Moderate Damage	0,430	0,520	0,352	1,285	0,257
Heavy Damage	0,565	0,620	0,510	1,550	0,458
Length	0,415	0,430	0,345	0,958	0,182
d	**1,840**	**2,205**	**1,657**	**5,330**	**0,958**

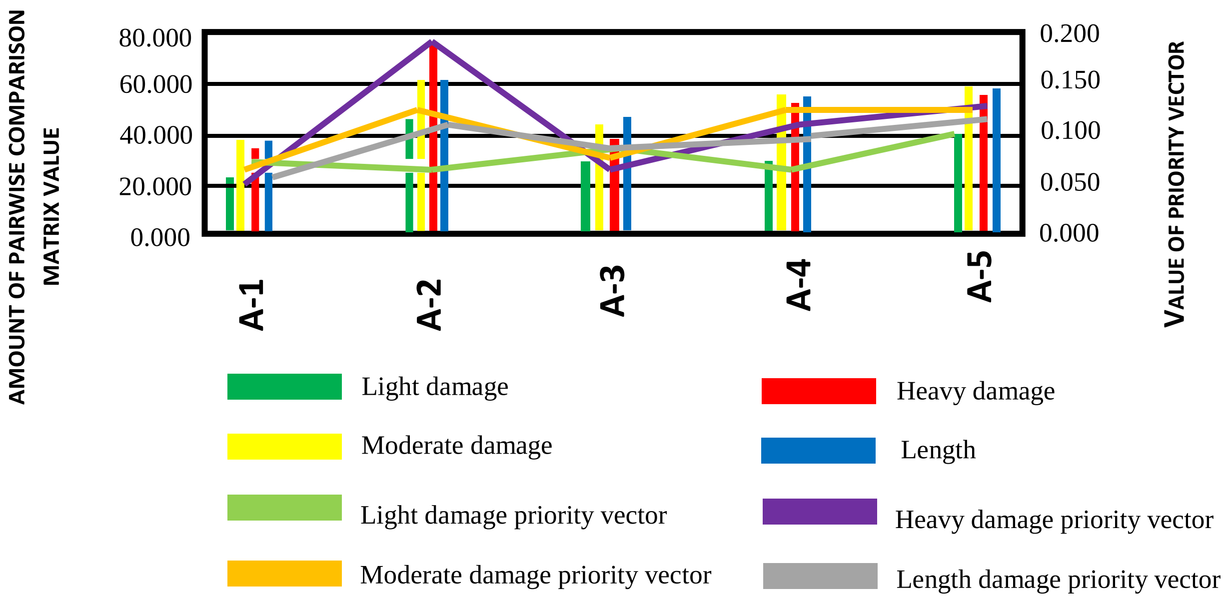

Figure 2: The Amount of Alternative Priority Vector Matrix

Table 7. The Synthesis Result from AHP Model

NO	CODE	VILLAGE	FINAL VALUE
1	A-2	Kepuh	0,195
2	A-4	Tanggullangin	0,112
3	A-5	Randugong	0,107
4	A-3	Lorokan	0,097
5	A-1	Kedung pengaron	0,054

According to table 7, the synthesis result from AHP model can be explained with the highest final value is found in A-2 (Kepuh village) by value of 0.195 whereas the lowest value is found in A -1 (Kedung Pengaron village) by value of 0,054. Difference found in each alternative value or in prioritized villages which occurred because of differences in assessment that producing different weights. The value of heavy damage parameter and length of damage parameter are those with the highest weights so that damage parameters become main factor for developing the effectiveness and rehabilitation construction for irrigation infrastructure. It applied to A-2 location that has the highest damage value (0.195) and very far in comparison to the value of A-1 (0,054) so, the A-2 location becomes the first priority or has the highest priority ranking to be chosen for damage repairs/improvement in its irrigation construction buildings.

V. CONCLUSION

From the analysis result to work performance evaluation of effectiveness and efficiency of the irrigation network system in the Krikilan irrigation area, Krajan district of Pasuruan Regency, the authors can draw conclusion as stated below:

1. To arrange and distribute irrigation water based on the planting time pattern for rice farms in Krikilan irrigation network, it can be done by calculating the water distribution where the average discharge amount for the first planting season (December-March) is 520 lt/sec, and the average discharge for the second planting season (April-July) is 385 lt/sec, and the average discharge for the third planting season (August-November) is 250 lt/sec, which taken from the intake channel and will be divided for irrigating rice plants (1.2 lt/sec) and irrigating the secondary crops (0.25 lt/s). Through this calculation, it will be possible to determine the systems of plants layout patterns to be applied in irrigated rice field patches during one year period with a sequential format of rice crops - secondary crops - secondary crops planting system.

2. From the irrigation network operational activities, the authors found many waters inundation on the pathways and village streets adjacent to rivers due to overflowing of river water or water canals during heavy rains and incoming floods. In addition, there are lots of soil buildups or sedimentation and garbage lumps which gave significant impact to the work performance of the irrigation network which functions to carry water and irrigate to tertiary patches until reaching the paddy patches. Therefore, Water Resources Service Department is carrying out an Irrigation Channel Normalization Program with activities that aimed to clean and dig up deposits/buildup of soil sedimentation in each river and canals that unable to discharge water completely. This normalization work has a target to minimize flood occurrence during rainy season also to smoothen water flow which initially halt as the result of water overflow due to soil or rubbish sedimentation in existing canals or rivers.
3. The activity of irrigation network rehabilitation has a purpose to support the development of construction project in irrigation sector. So, the authors reach final conclusion that annual checking and improvement activity must be carried out on each river or in the primary or secondary canals where the damage occurred to the main building. It is conducted to ensure the irrigation buildings can work properly and able to supply also divide the water equally with no water shortages/water losses coming from leaks in forms of cracked stones or collapsed stones at the corner of river stone walls. By applying the Analytical Hierarchy Process method, the accurate location with an urgency or becomes the priority for improvement in its irrigation construction can be located.

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