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***Research paper***

# Implementation of electre methods in determining for recipient candidate for pamsimas program in district pringsewu

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**Abstract**

Community-based Water Drinking Supply and Sanitation is one of the programs implemented by the Government of Indonesia with the support of the World Bank. One of the government targets under the RPJPN 2015-2019 is that Indonesia can provide drinking water and sanitation services for the people of Indonesia. The ELECTRE method is chosen because it is able to select the best alternative from the existing alternatives. This research used seven criteria as reference in determining for recipient candidate for PAMSIMAS program. The number of incidents of diarrheal diseases in one year (number of incidents), the number of people who have not used safe drinking water (individual), the number of people who have not used the toilet, the financial ability of the region, the income of the villagers, the distance of the source of clean water from the settlement, the availability of clean water. In addition to the criteria is also used the quality of the criteria to determine the best alternative and from the calculation of the alternative obtained the greatest value contained in A4 with value E = 4 and alternative A5 with the value E =4 thereby alternatives 4 and 5 are viable alternatives to the prospective recipient villages of the PAMSIMAS program in Pringsewu district.

***Keywords***: *Community-Based Water Drinking Supply and Sanitation (PAMSIMAS); ELECTRE; Pringsewu; Ranking.*

## 1. Introduction

### 1.1. Background

Community-based Water Drinking Supply and Sanitation (PAMSIMAS : bahasa abreviation) is one of the programs implemented by the Government of Indonesia with support from the World Bank, the program is being implemented to improve access to drinking water and sanitation services for the rural poor, especially those in rural and urban (peri-urban) communities. PAMSIMAS is a government effort to improve the provision of drinking water, sanitation and improve public health status, especially in reducing the number of diarrhea diseases and other diseases transmitted through environmental water.

In accordance with the role of RPJPN 2005-2025 and RPJM 2015-2019, Government through national development program 'Akses Universal Air Minum dan Sanitasi Tahun 2019', stipulates that by 2019, Indonesia can provide drinking water and proper sanitation for 100% of the Indonesian. For drinking water, nationally until 2015 Indonesia is only able to provide 68% of the total population of Indonesia, while for basic sanitation, Indonesia is only able to provide decent sanitation access for 60% of the total population of Indonesia, among underserved communities, low-income people in rural and peri-urban areas, including those vulnerable to accessing drinking water and adequate sanitation [1].

Based on the research [2] conducted a study on Public Participation in Community-based Water Drinking Supply and Sanitation (PAMSIMAS) in Sub-district Simpur, Hulu Sungai Selatan district . The research is a social study that examines the hope gap and realization of PAMSIMAS activities in the sub-district of Simpur, Hulu Sungai Selatan. This research also focuses on the level of participation, comparing villages receiving HID and those are not. This research finds the differences in the planning, implementation, and maintenance of the PANSIMAS program in villages receiving HID and those are not. Based on the research [3] has done research on the determination of slums in the region of Pringsewu using FMADM method. The research uses seven criteria that serve as a research reference. The criteria include drenage, garbage, distance between buildings, clean water, MCK, building density, and population density.

This research is conducted as an effort in determining PAMSIMAS program beneficiaries in Pringsewu District by applying several criteria of assessment which have been determined by electre method as the test. This research is expected to be able to assist PAMSIMAS program in reaching the under-served, including low-income people in rural areas who can not access drinking water and sanitation services, and improve the implementation of clean and healthy life and health values in order to achieve the target of access to drinking water and sanitation by 2019 in the water and sanitation sector, through the expansion of a community-driven development approach.

### 1.2. Research problem

Based on Background above, the formulation of the problem obtained is how to apply the ELECTRE as a method to determine the prospective recipient of PAMSIMAS?

### 1.3. Research objectives

The goal to be achieved in the application of electre method in determining pamasimas recipient candidates is to help the district government in determining the potential recipients of PAMSIMAS program with the criteria that have been determined by electre method.

# 2. Theoretical basis

## 2.1. Decision support system

Decision Support System (DSS) is defined as an information system to assist middle-level managers to semi-structured decision making processes (semi-structured) to be more effective by using analyst models and available data[4-5]
Decision Support System (SPK) began to develop in the 1960s, but the term Decision Support System itself only emerged in 1971, created by G. Anthony Gorry and Michael S. Scott Morton. They do so in order to create a framework for directing computer applications to management decision making. Meanwhile, the pioneering of other decision support systems, namely Petter GW Keen working with Scott Morton has defined three goals that must be achieved by the decision support system that is, the system must be able to assist managers in making decisions to solve semi-structured problems, the system must be able to supporting managers instead of trying to replace them and the system should be able to improve the effectiveness of manager decision making[6].

## 2.2. Pamsimas

PAMSIMAS stands for Community-Based Drinking Water and Sanitation. Water as the primary necessity of life, should be fulfilled in quality and quantity. But there are still many poor people in Indonesia who have not received proper clean water. The PAMSIMAS program is the Government's flagship program in community-based water supply and sanitation for the rural poor. The Government of Indonesia has a very strong commitment to achieve the Millennium Development Goals (MDGs), namely the decline in the number of people who do not have access to drinking water and basic sanitation by 50% by 2015. The scope of the PAMSIMAS Program activities includes 5 (five) project components namely Empowerment Community and Local Institutional Development, Health Improvement and Hygienic Behavior and Sanitation Services, Provision of Drinking Water and Public Sanitation Facilities, Provision of Water and Sanitation Facilities and Support of Project Implementation and Management[1].

## 2.3. Fuzzy multi attribute decision-making

Fuzzy Multi Attribute Decision Making is a method used to find the optimal alternative of a number of alternatives by using certain criteria [7]–[12]. There are several methods that can be used to solve FMADM problems such as, Simple Additive Waighting Method (SAW), Weighting Product (WP), Elimination Et Choix Traduisant la Realite (ELECTRE), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Analitycal Hierarchy Process (AHP)[5], [13]-[16]

# 3. Research method

## 3.1. Method of collecting data

a) Observation

Observation is a method of collecting data through observation or review carefully and directly in the field or research location. Through observation the author can see and observe and can gather information that may not be obtained during the interview. By doing the observation can also see the conditions and problems that exist in the environment

b) Study Library

Merupakan tahap pengumpulan data dengan mengumpulkan dan mempelajari berbagai referensi jurnal-jurnal terdahulu yang bersangkutan dengan masalah yang akan diteliti.

## 3.2. Electre method

ELECTRE (Elimination Et Choix Traduisant It realitE) is based on the concept of ranking through pairwise comparison between alternatives on appropriate criteria. An alternative is said to dominate other alternatives if one or more of the criteria exceed (compared to criteria of other alternatives) and equal to other remaining criteria [17]
According to Janko and Bernoider (2005: 11), ELECTRE is one of the multi-criteria decision-making methods based on the concept of outranking by using pairwise comparisons of alternatives based on each appropriate criteria. The electre method is used in conditions where alternatives that are less in line with the criteria are eliminated, and appropriate alternatives can be generated. In other words, electre is used for cases with many alternatives but few criteria are involved [18-20]
ELECTRE starts from forming a pairwise comparison of each alternative in each criterion. ($x_{ij}$). This value should be normalized to a comparable scale ($r_{ij}$):

1) Normalisation of decision Matrics.

In this procedure, each attribute is converted into a comparable value. Any normalization of the value can be done by the formula:

$$rij = \frac{x_{ij}}{\sum_{i=1}^{i} x_{ij}^2} \quad (1)$$

With i=1, 2,...,m;dan j=1,2,...n
then it is obtained matrics R result of normalisation

$$R = \begin{bmatrix} r_{12} & \cdots & r_{1n} \\ r_{22} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots \\ r_{m2} & \cdots & r_{mm} \end{bmatrix}$$

Further decision-making must provide a factor of importance (value) on each criteria expressing its relative importance (wj).
Valueing on a matrix that has been normalized. After normalization, each column of the matrix R is multiplied by the value (Wj) which is determined by the decision maker.

$$W = (w1, w2, \ldots wn) \quad (2)$$

With

$$\sum_{j=1} w_j = 1$$

This value is then multiplied by a matrix whose comparisons pair up into a matrix V :

$$Vij = wijxij \quad (3)$$

Devining concordance and discordance index
The formation of concordance and discordance index for each alternative pair is done through estimates of the ranking relationship. For each alternative pair Ak and A1 (k,l =1,2,...,m; and k1l), decision matrics for criteria j, devided into 2 subsets. First, the set of concordance index {ckl} shows the sum of the criteria values which are alternatives Ak better than alternatives Al.

$$Ckl = \{kj \geq v_{lj}\}; \text{ for } j=1,2,\ldots,n \quad (4)$$

Second, the set of discordance index {dkl} given as follow:

$$Dkl = \{kj < v_{lj}\}; \text{ for } j=1,2,\ldots,n. \quad (5)$$

Matrix count matriks concordance dan discordance
concordance

Matrixs of concordance index (C) contains elements calculated from the concordance index, and corresponds to the value of the attribute, namely:

$$Ckl = \sum_{kl} w_j \quad (6)$$

discordance
Similarly to the discordance matrix (D) contains elements calculated from the discordance index (Triantaphyllou, 2000). This matrix is related to attribute values, namely:

$$dkl = \frac{\left\{\left|v_{kj} - v_{lj}\right|\right\}_{j \in D_{kl}}}{x\left\{\left|v_{kj} - v_{lj}\right|\right\}_{vj}} \quad (7)$$

Determining the dominant matrixs concordance and discordance.
corcondance
these matrices can be constructed with the support of a threshold value (threshold), c. value c can be obtained with following formula:

$$c = \frac{\sum_{k=1}^{m}\sum_{l=1}^{m} C_{kl}}{m(m-1)} \quad (8)$$

alternative Ak can have a chance for dominance Al, if concordance index ckl beyond the threshold c:

$$Ckl \geq C \quad (9)$$

And the elements of the dominant concordance matrix F are determined as:

$$fkl = \begin{cases} 1, & \text{jika } c_{kl} \geq c \\ 0, & \text{jika } c_{kl} < c \end{cases} \quad (10)$$

discordance.
The same is true for the dominant discordance matrix G with threshold d can be obtained by the formula:

$$d = \frac{\sum_{k=1}^{m}\sum_{l=1}^{m} d_{kl}}{m(m-1)} \quad (11)$$

and the elements of the dominant discordance matrics F are determined as

$$g_{kl} = \begin{cases} 1, & \text{jika } d_{kl} \geq d \\ 0, & \text{jika } d_{kl} < d \end{cases} \quad (12)$$

6. Determining the aggregation of matrix dominance. The aggregation of the dominant matrix (E) which shows the sequence of partial preferences of the alternatives, is obtained by the formula:

ekl = fkl x gkl

Elimination of less favorable alternatives.
Matrix E provides a sequence of options from each alternative, that is, if ekl = 1 indicates that the Ak alternative is preferred over alternative Al.
In the research to determine the recipient of the Pansimas program in Pringsewu district using the ELECTRE method, we need the criteria of weight, weight value, and alternatives tested using several villages in pringsewu district.
Criteria of weight
The weight criteria in the research is to determine the recipient village of PAMSIMAS program using the ELECTRE method used criteria and weights to perform the calculation so that will get the best alternative. Table 1 shows criteria.

**Table 1:** Criteria

| Code | Criteria |
|---|---|
| C1 | The number of occurrences diarrhea a year ( the number of occurrences ) |
| C2 | The number of people who still not use a source of safe drinking water in individual |
| C3 | The number of people who still not use toilet |
| C4 | The ability regional financial |
| C5 | The low level of income members of the village community |
| C6 | The distance a source of clean water from the settlements |
| C7 | Clean water supply |

Weight of Criteria
Determining the weight value of each alternative on the criteria is to show the match rating of the alternatives in each criteria assessed by 1 to 5, this weighting gradation refers to the likert scale, namely:

1) = Very Low,
2) = Low,
3) = Enough,
4) = High,
5) = Very High.

# 4. Result and discussion

## 4.1. Discussion

Determining PAMSIMAS program beneficiaries using the ELECTRE method. Prospective recipients of the PAMSIMAS program are villages that meet several criteria of the program beneficiaries as the number of incidents of diarrhea in 1 year is high, the number of people who have not used safe drinking water sources, the number of people who have not used latrines, the financial capacity of the regions is minimal, distance source of clean water, and the availability of clean water is still lacking. Table 2 shows the criteria tested.

**Table 2:** The Criteria Tested

| Code | Criteria |
|---|---|
| C1 | The number of occurrences diarrhea a year |
| C2 | The number of people who still not use a source of safe drinking water (individual |
| C3 | The number of people who still not use toilet |
| C4 | The ability of regional financial |
| C5 | The low level of finantial income from village community |
| C6 | The distance a source of clean water from the settlements |
| C7 | Clean water supply |

Criteria Weighted Table. Table 3 shows c1, number of events in one year. Table 4 shows c2, number of population who have not used safe drinking water source. Table 5 shows c3, number of population who have not used toilet. Table 6 shows c4, regional financial capability. Table 7 shows c5, income of villagers. Table 8 shows c6, distance settlement from clean water source. Table 9 shows c7, clean water supply.

**Table 3:** C1. Number of Events in One Year

| No | Criteria | Weight | Description |
|---|---|---|---|
| 1 | >700 | 5 | ST |
| 2 | 500-699 | 4 | T |
| 3 | 300-499 | 3 | C |
| 4 | 100-299 | 2 | R |
| 5 | <100 | 1 | SR |

**Table 4:** C2. Number of Population Who Have Not Used Safe Drinking Water Source

| No | Criteria | Weight | Description |
|---|---|---|---|
| 1 | <200 kk | 1 | SR |
| 2 | 201-400 kk | 2 | R |
| 3 | 401-600 kk | 3 | C |
| 4 | 601-800 kk | 4 | T |
| 5 | >800 kk | 5 | ST |

**Table 5:** C3. Number of Population Who Have Not Used Toilet

| No | Criteria | Weight | Description |
|---|---|---|---|
| 1 | <200 kk | 1 | SR |
| 2 | 201-400 kk | 2 | R |
| 3 | 401-600 kk | 3 | C |
| 4 | 601-800 kk | 4 | T |
| 5 | >800 kk | 5 | ST |

**Table 6:** C4. Regional Financial Capability

| No | Criteria | Weight | Description |
|---|---|---|---|
| 1 | Fulfilled >10 % | 5 | VH |
| 2 | Fulfilled 8-10% | 4 | H |
| 3 | Fulfilled 6-7,9% | 3 | E |
| 4 | Fulfilled 3-5,9% | 2 | L |
| 5 | Fulfilled 1-2,9% | 1 | VL |

**Table 7:** C5. Income of Villagers

| No | Criteria | Weight | Description |
|---|---|---|---|
| 1 | 0 – 450.000 | 5 | ST |
| 2 | 451.000 – 800.000 | 4 | T |
| 3 | 801.000 -1.500.000 | 3 | C |
| 4 | 1.501.000– 3.000.000 | 2 | R |
| 5 | >3.000.000 | 1 | SR |

**Table 8:** C6. Distance Settlement from Clean Water Source

| No | Criteria | Weight | Description |
|---|---|---|---|
| 1 | 100-200 m | 5 | ST |
| 2 | 201-400 m | 4 | T |
| 3 | 401-600 m | 3 | C |
| 4 | 601-800 m | 2 | R |
| 5 | >800 m | 1 | SR |

**Table 9:** C7. Clean Water Supply

| No | Criteria | Weight | Description |
|---|---|---|---|
| 1 | Water Standard | 5 | VH |
| 2 | Water a drill | 4 | H |
| 3 | Water Embung | 3 | E |
| 4 | River Water | 2 | L |

In research is used 10 village in district pringsewu as samples which will be tested as shown in table 10 .

**Table 10:** Alternative Data

| No | Alternative | Village |
|---|---|---|
| 1 | A1 | Village 1 |
| 2 | A2 | Village 2 |
| 3 | A3 | Village 3 |
| 4 | A4 | Village 4 |
| 5 | A5 | Village 5 |
| 6 | A6 | Village 6 |
| 7 | A7 | Village 7 |
| 8 | A8 | Village 8 |
| 9 | A9 | Village 9 |
| 10 | A10 | Village 10 |

After knowing the data each village then gives weight for each criterion based on the data obtained in each village as shown in table 11.

**Table 11:** Match Rating of Each Alternative on Each Criterion

| | C1 | C2 | C3 | C4 | C5 | C6 | C7 |
|---|---|---|---|---|---|---|---|
| A1 | 5 | 1 | 4 | 3 | 2 | 3 | 2 |
| A2 | 1 | 5 | 3 | 2 | 4 | 2 | 3 |
| A3 | 4 | 2 | 1 | 3 | 5 | 5 | 2 |
| A4 | 2 | 4 | 2 | 1 | 3 | 4 | 5 |
| A5 | 1 | 3 | 5 | 2 | 4 | 1 | 4 |
| A6 | 3 | 2 | 3 | 1 | 5 | 4 | 3 |
| A7 | 5 | 3 | 2 | 1 | 4 | 2 | 2 |
| A8 | 3 | 4 | 1 | 5 | 2 | 3 | 2 |
| A9 | 4 | 1 | 5 | 2 | 3 | 5 | 2 |
| A10 | 2 | 5 | 3 | 4 | 1 | 2 | 4 |

Decision making gives preference weight as:

W= (4,5,3,4,3,2,5)

## 4.2. Calculation

The first step is to calculate a normalized decision matrix based on the equation

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{t} x_{ij}^2}} \quad (1)$$

$$= \frac{}{\sqrt{+1^2+4^2+2^2+1^2+3^2+5^2+3^2+4^2+2^2}} = 110$$

= 10,488

$$|X_2| = \sqrt{1^2+5^2+2^2+4^2+3^2+2^2+3^2+4^2+1^2+5^2}$$

= 110

= 10,488

$$|X_3| = \sqrt{4^2+3^2+1^2+2^2+5^2+3^2+2^2+1^2+5^2+3^2}$$

= 103

= 10,148

$$|X_4| = \sqrt{3^2+2^2+3^2+1^2+2^2+1^2+1^2+5^2+2^2+4^2}$$

= 74

= 8,6023

$$|X_5| = \sqrt{2^2+4^2+5^2+3^2+4^2+5^2+4^2+2^2+3^2+1^2}$$

= 125

= 11,180

$$|X_6| = \sqrt{3^2+2^2+5^2+4^2+1^2+4^2+2^2+3^2+5^2+2^2}$$

= 113

= 10,630

$$|X_7| = \sqrt{2^2+3^2+2^2+5^2+4^2+3^2+2^2+2^2+2^2+4^2}$$

= 95

= 9,746

From the above calculation obtained normalized matrix R

$$R = \begin{bmatrix} 0,4767 & 0,0953 & 0,3941 & 0,3487 & 0,1788 & 0,2822 & 0,2051 \\ 0,0953 & 0,4767 & 0,2955 & 0,2324 & 0,3577 & 0,1881 & 0,3077 \\ 0,3813 & 0,1906 & 0,0985 & 0,3487 & 0,4472 & 0,4703 & 0,2051 \\ 0,1906 & 0,3813 & 0,1970 & 0,1162 & 0,2683 & 0,3762 & 0,5129 \\ 0,0953 & 0,2860 & 0,4926 & 0,2324 & 0,3577 & 0,0940 & 0,4103 \\ 0,2860 & 0,1906 & 0,2955 & 0,1162 & 0,4472 & 0,3762 & 0,3077 \\ 0,4767 & 0,2860 & 0,1970 & 0,1162 & 0,3577 & 0,1881 & 0,2051 \\ 0,2860 & 0,3813 & 0,0985 & 0,5812 & 0,1788 & 0,2822 & 0,2051 \\ 0,3813 & 0,0953 & 0,4926 & 0,2324 & 0,2683 & 0,4703 & 0,2051 \\ 0,1906 & 0,4767 & 0,2955 & 0,4649 & 0,0894 & 0,1881 & 0,4103 \end{bmatrix}$$

Having obtained the normalized matrix R, then look for the matrix V based on the equation:

$$V_{ij} = w_{ij} x_{ij} \quad (3)$$

From the above calculation obtained matrix V =

| | | | | | | |
|---|---|---|---|---|---|---|
| 1,9069 | 0,4767 | 1,1823 | 1,3949 | 0,5366 | 0,5644 | 1,0259 |
| 0,3813 | 2,3836 | 0,8867 | 0,9299 | 1,0733 | 0,3762 | 1,5389 |
| 1,5255 | 0,9534 | 0,2955 | 1,3949 | 1,3416 | 0,9407 | 1,0259 |
| 0,7627 | 1,9069 | 0,5911 | 0,4649 | 0,8049 | 0,7525 | 2,5649 |
| 0,3813 | 1,4301 | 1,4779 | 0,9299 | 1,0733 | 0,1881 | 2,0519 |
| 1,1441 | 0,9534 | 0,8867 | 0,4649 | 1,3416 | 0,7525 | 1,5389 |
| 1,9069 | 1,4301 | 0,5911 | 0,4649 | 1,0733 | 0,3762 | 1,0259 |
| 1,1441 | 1,9069 | 0,2955 | 2,3249 | 0,5366 | 0,5644 | 1,0259 |
| 1,5255 | 0,4767 | 1,4779 | 0,9299 | 0,8049 | 0,9407 | 1,0259 |
| 0,7627 | 2,3836 | 0,8867 | 1,8599 | 0,2683 | 0,3762 | 2,0519 |

Next determining the set of concordance and discordance index based on the equation

a) Concordance index

$$Ckl = \{kj \geq v_{lj}\}; \text{ for } j=1,2,...,n. \quad (4)$$

b) Discordance

$$Dkl = \{j|v_{kj} < v_{lj}\}; \text{ for } j=1,2,...,n \quad (5)$$

After the above calculation there will be formed concordance. The elemen of $c_{kl}$ will be counted based on the equation:

$$Ckl = \sum_{kl} w_j \quad (6)$$

Matrics concordance

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| – | 13 | 16 | 11 | 10 | 11 | 18 | 17 | 18 | 12 |
| 13 | – | 13 | 15 | 18 | 17 | 22 | 16 | 17 | 13 |
| 19 | 13 | – | 13 | 13 | 18 | 14 | 17 | 23 | 9 |
| 15 | 11 | 13 | – | 16 | 16 | 19 | 18 | 13 | 14 |
| 16 | 19 | 13 | 10 | – | 17 | 20 | 11 | 20 | 11 |
| 15 | 17 | 16 | 16 | 9 | – | 17 | 17 | 13 | 12 |
| 17 | 9 | 17 | 14 | 14 | 13 | – | 15 | 17 | 11 |
| 19 | 10 | 17 | 13 | 15 | 13 | 16 | – | 14 | 13 |
| 18 | 13 | 14 | 16 | 13 | 13 | 14 | 17 | – | 12 |
| 14 | 23 | 17 | 16 | 20 | 17 | 19 | 13 | 14 | – |

Next on the discordance matrix. Element of $d_{kl}$ will be counted based the equation

$$dkl = \frac{\{|v_{kj} - v_{lj}|\}_{j \in D_{kl}}}{x\{|v_{kj} - v_{lj}|\}_{\forall j}} \quad (7)$$

From the above calculation obtained the following discordance matrix:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| – | 0,39627 | 0,42432 | 0,16444 | 0,19377 | 0,20231 | 0,5770 | 1,0487 | 0,57706 | 0,4064 |
| 0,09866 | – | 0,18762 | 0,78931 | 0,53803 | 0,18762 | 1,6 | 0,31824 | 0,29599 | 0,47378 |
| 0,47378 | 0,44836 | – | 0,31785 | 0,41667 | 0,55161 | 0,31785 | 1,15528 | 2,20326 | 0,43323 |
| 0,38415 | 0,36153 | 0,12225 | – | 0,4754 | 0,28811 | 0,17436 | 0,34782 | 0,12225 | 0,55081 |
| 0,36676 | 0,31824 | 0,22694 | 0,43007 | – | 0,45387 | 0,18338 | 0,31824 | 0,73352 | 0,23372 |
| 0,36721 | 0,60961 | 0,31824 | 1,77667 | 0,60961 | – | 0,92932 | 1,18445 | 0,35059 | 0,47795 |
| 0,19733 | 0,19377 | 0,56285 | 1,34507 | 0,3048 | 0,35178 | – | 0,24666 | 0,48769 | 0,25835 |
| 0,53333 | 0,34175 | 0,39465 | 0,10115 | 0,38471 | 0,10115 | 0,15893 | – | 0,18762 | 1,02525 |
| 1,01355 | 0,23452 | 0,39326 | 1,61277 | 0,23452 | 0,80638 | 0,30258 | 1,17979 | – | 1,21922 |
| 0,09866 | 0,86559 | 0,39466 | 0,26975 | 0,62005 | 0,2631 | 0,57706 | 0,18338 | 0,28142 | – |

Next looking for the values of c and d using the equation

$$c = \frac{\sum_{k-1}^{m} \sum_{l-1}^{m} C_{kl}}{m(m-1)} \quad (8)$$

And

$$d = \frac{\sum_{k-1}^{m} \sum_{l-1}^{m} d_{kl}}{m(m-1)} \quad (9)$$

$$c = \frac{\sum_{k-1}^{m} \sum_{l-1}^{m} C_{kl}}{m(m-1)} = \frac{jumlah\ seluruh\ nilai\ matrik\ corcondance}{10\,(10-1)} = \frac{1351}{90} = 15{,}0111$$

$$d = \frac{\sum_{k-1}^{m} \sum_{l-1}^{m} d_{kl}}{m(m-1)} = \frac{jumlah\ seluruh\ nilai\ matrik\ discordance}{10(10-1)} = \frac{-44{,}97964}{90} = -0{,}49977$$

Next determining the dominant corcondance matrix and the dominant discordance using the equation

$$fkl = \begin{cases} 1, & \text{jika } c_{kl} \geq c \\ 0, & \text{jika } c_{kl} < c \end{cases} \quad (10)$$

$$\text{Dan } g_{kl} = \begin{cases} 1, & \text{jika } d_{kl} \geq d \\ 0, & \text{jika } d_{kl} < d \end{cases} \quad (11)$$

c) Dominant concordance matrix

The dominant concordance matrix is calculated based on the equation as shown in table 12.

$$Fkl = \begin{cases} 1, & \text{jika } c_{kl} \geq c \\ 0, & \text{jika } c_{kl} < c \end{cases}$$

**Table 12:** Dominant Concordance Matrix (F)

| | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 0 | 0 | | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 | | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 | | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 | | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 | | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | |

d) The dominant discordance matrix

The dominant discordance matrix is calculated based on the equation as shown in table 13.

$$g_{kl} = \begin{cases} 1, & \text{jika } d_{kl} \geq d \\ 0, & \text{jika } d_{kl} < d \end{cases}$$

**Table 13:** Matrices of Dominant Discordance (G)

| | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | | 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 | | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | |

Having determined the dominant corcondance matrix and the dominant discordance further determines the dominant matrix aggregation. Table 14 shows dominant aggregation matrices from combinations of matrices F and G. The aggregation of the dominant matrix (E) which shows the sequence of partial preferences of the alternatives, is obtained by the formula:

ekl = fkl x gkl

**Table 14:** Dominant Aggregation Matrices from Combinations of Matrices F and G

| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 | | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | |

Based on the value obtained it can be concluded that alternative 9 can be eliminated because it has fewer element values compared with other alternatives.

## 5. Conclusion and suggestion

### 5.1. Conclusion

From this research, it can be concluded that the method of Elimination Et Choix Tranduisant Ia realitE (ELECTRE) can be used to determine the recipient of the program PAMSIMAS in district of pringsewu by using some of the criteria used in this study as: (1) Number of diarrheal diseases in one year (number of incidents), (2) Number of people who have not used safe drinking water sources, (3) Population not yet using toilet, (4) local financial capacity, (5) Income of villagers, (6) Distance of clean

water source from settlement, and the (7) Availability of clean water.

### 5.2. Suggestion

In this study, researcher used only seven criteria. As for suggestions for future researchers, this research can still be developed again by adding criteria, changing the criteria value or by using other methods as well as development into the expert system with the application form.

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