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Decision Support System for Performance Assessment of Honoray Personnel Applying *MABAC*, *MOORA*, and *ARAS* Method with a Combination of *ROC* Weighthing

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A R T I C L E I N F O

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A B S T R A C T

MABAC (*Multi-Attributive Border Approximation area Comparison*), *ARAS* (*Additive Ratio Assessment*), and *MOORA* (*Multi-Objective Optimization on the basis of Ratio Analysis*) are decision support system methods employed for evaluating the performance of honorary staff. *MABAC* utilizes a multi-attribute border approximation area approach to measure the relative performance of honorary staff. *ARAS* assigns weights to competing attributes and produces assessment ratio values aiding in decision-making. Meanwhile, *MOORA* focuses on multi-objective optimization by considering ratio analysis. The combination of these three methods provides a holistic and comprehensive framework for assessing the performance of honorary staff, enabling decision-makers to effectively evaluate their contributions and achievements based on predefined criteria. This approach allows for the determination of relative rankings and the selection of honorary staff that best align with organizational needs

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INTRODUCTION

A Decision Support System (*DSS*) is a system that helps designers or decision makers, either at the individual or corporate level, to take an objective and accurate decision action. SPK can be used to solve complex problems by considering various relevant factors and criteria. The methods used in DSS can vary, such as *MABAC*, *MOORA*, *ARAS*, and others, depending on the type of problem to be solved. In addition, DSS can also use weighting techniques such as *ROC* to determine the weight of criteria used in decision making (Saprudin et al., 2019)

Honorary employee is someone who serves in a company that deserves to be hired as a daily employee with a predetermined period and also with a definite salary from the company working. with a predetermined period and also with a definite salary from the company working. In the company is required to select Honorary Employees. Selection of Honorary Employees is very important to to convince companies or agencies and business entities that someone who is hired is right and can improve the performance of Honorary Employees in work and improve the performance of Honorary Employees in work. improve the performance of Honorary Employees at work and is very worthy to be an Honorary Employee.The problem experienced in this research is about the Honorary Employee Selection process. Within the institution Medan Sinembah Village of course there are Honorary Employees, and to realize all of that is not easy because there is still a selection process in the appointment of Honorary Employees. because there is still a selection process in the appointment of Honorary Employees. As for the Employee Selection process The Honorary Employee Selection process is very time consuming because it must have all the requirements to become an Honorary Employee in Medan Sinembah Village. An Honorary Employee in Medan Sinembah Village. The selection of Honorary Employees so far only looks at Education only, whereas in the Honorary Employee Selection process must use several criteria. As for what criteria in this study are Education, Age, Height, Distance from Home, Work Experience, Character and Test Score. From the problems encountered, it is very appropriate for the Medan Sinembah Village to implement a Decision Support System. apply a Decision Support System. Decision Support System is the right solution to solve this problem. Until now, there have been many previous studies that aim to solve problems related to election. related to Election matters. Some related research that has been researched by other researchers such as Research Samuel Manurung discusses research on decision support systems for selecting the best teachers and employees, with criteria of common sense, verbalization of ideas, systematic thinking, reasoning and real solutions, concentration, practical logic, flexibility of thinking, creative imagination, anticipation, intelligence potential, psychic energy, rigor and responsibility, prudence, emotional control, drive for achievement, vitality and planning, dominance, influence, steadiness, and compliance. and compliance. To choose the best teachers and employees, a decision support system is needed. Research This research designs a decision support system using the *MABAC*, *MOORA*, and *ARAS* methods (Munthe et al., 2022).

LITERATURE REVIEW

Decision Support System (*DSS*)

The concept of Decision Support Systems was introduced in the early 1970s by Michael SS. Scoot Morton with the term Management Decision System. This system is a computer-based system that aims to facilitate decision making by using certain data and models in solving various irregular problems. solve various irregular problems. According to (McLeod, 2001) in Yulyantari & Wijaya (2018: 10) *DSS* is a system that helps a person or small group of managers who work as a team to solve certain problems. as a team of specific problem solvers.

According to Little (turban, 2005) in Yulyantari & Wijaya (2018: 10) Defines *DSS* as a set of process models for processing data with the aim of supporting managers' decision making in making certain decisions. making certain decisions. *DSS* is a specialized information system intended to help management make decisions related to semi-structured problems. management make decisions related to semi-structured problems. This system has facilities so that it can produce various alternatives that are used interactively by users (Nofriansyah & Defit 2020: 2).

MABAC (Multi-Attributive Border Approximation Area Comparison)

MABAC stands for the word Multi-Attributive Border Approximation Area Comparison is a multicriteria comparison method. The *MABAC* method has six process steps, namely Formation of initial decision matrix, Normalization of initial matrix, Calculation of weighted matrix, Determination of border approximation area matrix, Calculation of alternative distance matrix elements from border approximation area, Ranking alternatives. The basic assumption of the *MABAC* method is reflected in the definition of the criterion distance function of each alternative observed from the approximate boundary area.

The *MABAC* method was developed by Pamucar and Cirovic. This method was chosen because with other multi-criteria decision making methods such as SAW, COPRAS, *MOORA*, *TOPSIS* and *VIKOR*, the *MABAC* method provides a stable (consistent) solution and this method is considered a reliable method for rational decision making, as described in the journal Indic D. & Lukovic. In this paper the *MABAC* method is used for ranking alternatives. The basic assumption of the *MABAC* method is reflected in the definition of the criterion function distance of each observed alternative from the approximate limit. By applying this *MABAC* (Multi-Attributive BorderApproximation area Comparison) method can speed up the process of determining the selection of branch heads.

MOORA (Multi-Objective Optimization)

MOORA was introduced by Brauers in 2004 as a "multi-objective optimization", optimizing more than one value calculation function to have an effective value that can be achieved within the boundaries of its own region so that the search does not widen everywhere, which can be used to solve various problems in decision making (Wardani et al., n.d.).

According to (R & Haliq, 2021) and (Nugroho et al., 2022) Multi_Objective Obtimization by Ratio Analysis (*MOORA*) is a multi-objective system that can maximize two or more attributes simultaneously and oppositely.This method uses multiplication, as a link between attributes, after which the attributes are multiplied by their weights, then a reference is sought from the attributes. First the weight, then look for references from alternatives. This method is also easy to understand and flexible (Yendrizal, 2020) and (Suwandana & Wati, 2020). The stages of the *MOORA* method according to (El Faritsi et al., 2022) and (Lestari & Sudarsono, 2022).

***ARAS* (Additive Ratio Assessment)**

According to David simamarta et al (2019) The *ARAS* method is one of the Multicriteria Decision Making (MCDM) methods developed by Zavadskas in 2010. this research implements the *ARAS* method to provide recommendations for healthy visiting patients at FKTP dr. Josepb Nugroho H.S. This research utilizes the data owned by FKTP dr. Josepb Nugroho H.S in producing participant recommendations. The results of these recommendations are processed into geographic information because the way FKTP dr. Josepb Nugroho H.S contacts healthy visiting patients is by providing an invitation letter to come to FKTP for counseling.

According to Azmi (2020) in his research entitled The Best Military Police Selection Decision Support System Using the Additive Ratio Assessment (*ARAS*) Method. The Additive Ratio Assessment (*ARAS*) method is a comprehensive framework method by considering a hierarchical process which is then carried out by a method used for ranking criteria, calculating weights to calculate a criterion in determining the best Military Police.

ROC

According to (Ndruru, 2020), *ROC* is a method used to provide the necessary weights for ranking in decision support systems. *ROC* operates by emphasizing that the first criterion is more important than the second, the second is more important than the third, and so on. According to (Mahdi et al., 2023), *ROC* is a direct approach that refers to the level of importance or priority of a criterion in generating weights. In this case, the Rank Order Centroid (*ROC*) method is used to give weight to each criterion.

Based on the explanation above, it can be concluded that *ROC* is a method used to provide the weights needed to perform ranking in a decision support system. *ROC* operates by emphasizing the priority of criteria, where the first criterion is considered more important than the second criterion, and so on. In addition, *ROC* is described as a direct approach that determines the importance or priority of a criterion in generating weights.

METHODOLOGY

This study employs a qualitative methodology, starting with a phase of literature review in which the author gathers pertinent sources regarding honorary employee performance reviews and the *MABAC*, *ARAS*, and *MOORA* techniques. This stage establishes a strong theoretical framework for additional study. The next step is problem identification, during which the researcher thoroughly analyzes and identifies the issues that emerge and decides which ones need to be resolved.

The following step is data collecting, in which the investigator gathers information on the problems that have already been identified based on research findings. The data obtained is examined in accordance with the study objectives, particularly when evaluating the work of honorary staff members. In addition, the *MABAC*, *ARAS*, and *MOORA* methodologies are analyzed and applied in this study. Considering their vital importance in research, these approaches have been carefully selected. One strategy used in the application of these techniques is the use of *ROC* weighting.

Following the presentation of the research findings, the best honorary employee performance evaluation is selected based on the predetermined criteria. The researcher analyzes the ranking of the chosen honorary employee performance assessment based on the criteria employed in the conclusion, which is a crucial final step. These findings offer a summary of the study, address the issues that were previously noted, and might offer ideas for future research topics. Therefore, in order to address the research issues posed, this study creates a logical and systematic sequence of steps..

RESULTS

In this study, researchers used the *MABAC* (Multi-Attributive Border Approximation area Comparison), *ARAS* (Additive Ratio Assessment), and *MOORA* (Multi-Objective Optimization on the basis of Ratio Analysis) methods in the process of assessing the performance of honorary personnel. The *MABAC*, *ARAS* and *MOORA* methods require preference criteria and weights to determine the best alternative.

a. Determination of Criteria, Weights and Alternatives

Producing the best alternative requires how many attributes or criteria are used as internal requirements problem solving, as well as the weight of each conflicting criteria.

Table 1. Criteria

Criteria	**Description**	**Type**
C1	Work Discipline	Benefit
C2	Teamwork	Benefit
C3	Commitment	Benefit
C4	Service Orientation	Benefit
C5	Education	Benefit
C6	Politeness	Cost

From the results of the table above, there are 6 criteria which can be explained as follows:

1. Work Discipline
   Work discipline is behavior that is regular, obedient to rules, and consistent in carrying out tasks or work. This includes adherence to work norms, punctuality, responsibility for tasks, and providing good quality work.
2. Teamwork
   Teamwork is the process of individuals working together in a team or group to achieve a common goal. Teamwork involves a process of

collaboration, communication, coordination and trust between members to maximize work productivity.

3. Commitment
   Commitment is a person's determination or willingness to engage fully in an action, decision, or relationship. Commitment includes involvement, dedication and perseverance towards a goal or value. Commitment can be professional, personal or interpersonal, reflecting seriousness and consistency in carrying out obligations or relationships.
4. Service Orientation
   Service orientation is the attitude and work behavior of civil servants in providing the best service to those served, both to the public, superiors, colleagues, related work units, and / or other agencies.
5. Education
   Education is a learning process carried out both formally and non-formally which aims to educate, provide knowledge, and develop the potential that exists in every human being, then realize a better learning process.
6. Politeness
   Politeness is a set of unwritten rules that govern individual behavior in social interactions. These rules determine how we should behave, speak and respond in various situations.

Furthermore, the data for each alternative obtained can be seen in Table 2.

Table 2. Alternative

Alternative	C1	C2	C3	C4	C5	C6
Sinta (A1)	Good	Good	Good	Good	Diploma III	Very Good
Gisel (A2)	Quite Good	Good	Quite Good	Good	High School	Very Good
Loli (A3)	Quite Good	Quite Good	Good	Quite Good	High School	Good
Karin (A4)	Very Good	Very Good	Very Good	Good	Bachelor's Degree	Good
Maya (A5)	Good	Good	Quite Good	Very Good	Bachelor's Degree	Very Good
Cinta (A6)	Very Good	Good	Good	Good	Diploma III	Quite Good

In Table 2 above, most of the data is linguistic, such as Very Good, Good, and Good Enough. This data needs to be weighted so that the value for alternatives can be calculated using the *MABAC* (Multi-Attributive Border Approximation area Comparison), *ARAS* (Additive Ratio Assessment), and *MOORA* (Multi-Objective Optimization on the basis of Ratio Analysis) methods. apply *ROC* weighting. The weighting can be seen in Table 3 below:

Table 3. Weight of Criteria Values

Criteria	Description	Value
	Very Good	3
C1	Good	2
	Quite Good	1
	Bachelor's Degree	3
C5	Diploma III	2
	High School	1

After the weighting of criteria values is completed, the next step is to create a compatibility rating, which can be observed in the following Table 4.

Table 4. Compatibility Rating

Alternative	C1	C2	C3	C4	C5	C6
Sinta (A1)	2	2	2	2	2	3
Gisel (A2)	1	2	1	2	1	3
Loli (A3)	1	1	2	1	1	2
Karin (A4)	3	3	3	2	3	2
Maya (A5)	2	2	1	3	3	3
Cinta (A6)	3	2	2	2	2	1

After the suitability ranking is determined in Table 4 above, the next step is to perform calculations using the *MABAC* (Multi-Attributive Border Approximation Area Comparison), *ARAS* (Additive Ratio Assessment), and *MOORA* (Multi-Objective Optimization on the basis of Ratio Analysis) methods that apply *ROC* weighting.

The following are the weights obtained using the Rank Order Centroid (*ROC*) method as shown below:

$$W1 = \frac{1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}}{6} = 0.41$$

$$W2 = \frac{0 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}}{6} = 0.24$$

$$W3 = \frac{0 + 0 + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}}{6} = 0.16$$

$$W4 = \frac{0 + 0 + 0 + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}}{6} = 0.10$$

$$W5 = \frac{0 + 0 + 0 + 0 + \frac{1}{5} + \frac{1}{6}}{6} = 0.06$$

$$W6 = \frac{0 + 0 + 0 + 0 + 0 + \frac{1}{6}}{6} = 0.03$$

After applying *ROC* weighting, the next step is to perform calculations using the *MABAC* (Multi-Attributive Border Approximation Area Comparison), *ARAS* (Additive Ratio Assessment), and *MOORA* (Multi-Objective Optimization on the basis of Ratio Analysis) methods.

DISCUSSION

a. *MABAC* (MultiAttributive Border Approximation Area Comparison)

1. Normalization of initial matrix (X) elements

$$X = \begin{bmatrix} 2 & 2 & 2 & 2 & 2 & 3 \\ 1 & 2 & 1 & 2 & 1 & 3 \\ 1 & 1 & 2 & 1 & 1 & 2 \\ 3 & 3 & 3 & 2 & 3 & 2 \\ 2 & 2 & 1 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 & 2 & 1 \end{bmatrix}$$

2. Normalization Matrix Initial decision (X)

Max and Min values of each criterion

Max C_1 : 3 ; Min C_1 : 1

Max C_2 : 3 ; Min C_2 : 1

Max C_3 : 3 ; Min C_3 : 1

Max C_4 : 3 ; Min C_4 : 1

Max C_5 : 3 ; Min C_5 : 1

Max C_6 : 3 ; Min C_6 : 1

Determine the normalization value of the matrix with the criteria Work Discipline, Teamwork, Commitment, Service Orientation, Education these criteria are benefits while Politeness is cost.

Benefits

$\text{TiJ} = \frac{Xij - Xi^{-}}{Xi+ - Xi^{-}}$

Cost

$\text{TiJ} = \frac{Xij - Xi+}{Xi^{-} - Xi+}$

Where xij, $xi+$ and $xi-$ present the elements of the initial decision matrix (X), where $xi+$ and $xi-$ are defined as follows:

$xi+$ = max (x1, x2, x3, ..., xm) represents the maximum value of the criteria observed by the alternative.

$xi-$ = min (x1, x2, x3, ..., xm) represents the minimum value of the criteria observed by the alternative.

Criteria 1 (C1) Benefit

$T_{11} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$

$T_{21} = \frac{1-1}{3-1} = \frac{0}{2} = 0$

$T_{41} = \frac{3-1}{3-1} = \frac{2}{2} = 1$

$T_{51} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$

$T_{31} = \frac{1-1}{3-1} = \frac{0}{2} = 0$ $T_{61} = \frac{3-1}{3-1} = \frac{2}{2} = 1$

Criteria 2 (C_2) Benefit

$T_{12}\,\frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$ $t_{42}\,\frac{3-1}{3-1} = \frac{2}{2} = 1$

$T_{22}\,\frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$ $t_{52}\,\frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$

$T_{32}\,\frac{1-1}{3-1} = \frac{0}{2} = 0$ $t_{62}\,\frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$

Criteria 3 (C_3) Benefit

$t_{13} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$ $t_{33} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$

$t_{23} = \frac{1-1}{3-1} = \frac{0}{2} = 0$ $t_{43} = \frac{3-1}{3-1} = \frac{2}{2} = 1$

$t_{53} = \frac{1-1}{3-1} = \frac{0}{2} = 0$ $t_{63} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$

Criteria 4 (C_4) Benefit

$t_{14} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$ $t_{44} = \frac{3-1}{3-1} = \frac{1}{2} = 0{,}5$

$t_{24} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$ $t_{54} = \frac{3-1}{3-1} = \frac{2}{2} = 1$

$t_{34} = \frac{1-1}{3-1} = \frac{0}{2} = 0$ $t_{62} = \frac{2-1}{3-1} = \frac{1}{2} = 0.5$

Criteria 5 (C_5) Benefit

$t_{15} = \frac{2-1}{3-1} = \frac{1}{2} = 0{,}5$ $t_{45} = \frac{3-1}{3-1} = \frac{2}{2} = 1$

$t_{25} = \frac{1-1}{3-1} = \frac{0}{2} = 0$ $t_{55} = \frac{3-1}{3-1} = \frac{2}{2} = 1$

$t_{35} = \frac{1-1}{3-1} = \frac{0}{2} = 0$ $t_{65} = \frac{2-1}{3-1} = \frac{1}{2} = 0.5$

Criteria 6 (C_6) Cost

$t_{16} = \frac{3-3}{1-3} = \frac{0}{-2} = 0$ $t_{46} = \frac{2-3}{1-3} = \frac{-1}{-2} = 0{,}5$

$t_{25} = \frac{3-3}{1-3} = \frac{0}{-2} = 0$ $t_{56} = \frac{3-3}{1-3} = \frac{2}{=2} = 0$

$t_{35} = \frac{1-1}{3-1} = \frac{-1}{-2} = 0{,}5$ $t_{66} = \frac{1-3}{1-3} = \frac{-2}{-2} = 1$

Normalization result

$$N = \begin{bmatrix} 0,5 & 0,5 & 0,5 & 0,5 & 0,5 & 0 \\ 0 & 0,5 & 0 & 0,5 & 0 & 0 \\ 0 & 0 & 0,5 & 0 & 0 & 0,5 \\ 1 & 1 & 1 & 0,5 & 1 & 0,5 \\ 0,5 & 0,5 & 0 & 1 & 1 & 0 \\ 1 & 0,5 & 0,5 & 0,5 & 0,5 & 1 \end{bmatrix}$$

3. Calculation of weighted matrix (V) elements Here is the formula for finding the value of the weighted matrix weight element

$V_{ij} = (W_i * t_{ij}) + W_i$

Criteria (C_1) W_1 = 0,41

V_{11} = (0,41 x 0,5) + 0,41= 0,615

V_{21} = (0,41 x 0)+ 0,4 = 0,41

V_{31} = (0,41 x 0)+ 0,41= 0,41

V_{41} (0,41 x 1)+ 0,41 = 0,82

V_{51} (0,41 x 0,5)+0,41=0,615

V_{61} (0,41 x 1)+0,41=0,82

Criteria (C_2) W_2 = 0,24

V_{12} = (0,24 x 0,5) + 0,24 = 0,36

V_{22} = (0,24 x 0,5) + 0,24 = 0,36

V_{32} = (0,24 x 1) + 0,24 = 0,24

V_{42} = (0,24 x 1) + 0,24 = 0,48

V_{52} = (0,24 x 0,5) + 0,24 = 0,36

V_{62} = (0,24 x 0,5) + 0,24 = 0,36

Criteria (C_3) W_3 = 0,16

V_{13} = (0,16 x 0,5) + 0,16 = 0,24

V_{23} = (0,16 x 0) + 0,16 = 0,16

V_{33} = (0,16 x 0,5) + 0,16 = 0,24

V_{43} = (0,16 x 1) + 0,16 = 0,32

V_{53} = (0,16 x 0) + 0,16 = 0,16

V_{63} = (0,16 x 0,5) + 0,16 = 0,24

Criteria (C_4) W_4 = 6,10

V_{14} = (0,10 x 0,5) +0,10 = 0,15

V_{24} = (0,10 x 0,5)+ 0,10 = 0,15

V_{34} = (0,10 x 0) + 0,10 = 0,10

V_{44} = (0,10 x 0,5)+ 0,10 = 0,15

V_{54} = (0,10 x 1) + 0,10 = 0,20

V_{64} = (0,10 x 0,5) + 0,10 = 0,15

Criteria (C_5) W_5 = 0,06

V_{15} = (0,06 x 0,5) + 0,06 = 0,09

V_{25} = (0,06 x 0) + 0,06 = 0,06

V_{35} = (0,06 x 0) + 0,06 = 0,06

V_{45} = (0,06 x 1) + 0,06 = 0,12

V_{55} = (0,06 x 1) + 0,06 = 0,12

V_{65} = (0,06 x 0,5) + 0,06 = 0,09

Criteria (C_6) W_6 = 0,03

V_{16} = (0,03 x 0) + 0,03 = 0,03

V_{26} = (0,03x 0)+ 0,03 = 0,03

V_{36} = (0,03 x 0,5) + 0,03 = 0,045

V_{46} = (0,03 x 0,5) + 0,03 = 0,045

V_{56} = (0,03 x 0) + 0,03 = 0,03

V_{66} = (0,03 x 1) + 0,03 = 0,06

$$V = \begin{bmatrix} 0,615 & 0,36 & 0,24 & 0,15 & 0,09 & 0,03 \\ 0,41 & 0,36 & 0,16 & 0,15 & 0,66 & 0,03 \\ 0,41 & 0,24 & 0,24 & 0,10 & 0,06 & 0,45 \\ 0,82 & 0,48 & 0,32 & 0,15 & 0,12 & 0,45 \\ 0,815 & 0,36 & 0,16 & 0,20 & 0,12 & 0,03 \\ 0,82 & 0,36 & 0,24 & 0,15 & 0,09 & 0,06 \end{bmatrix}$$

4. Determination of border approximate area matrix (G)

M = number of alternatives

M = $\frac{1}{6}$ = 0,16

$G_{c1} = (0{,}615 \times 0{,}41 \times 0{,}41 \times 0{,}82 \times 0{,}615 \times 0{,}82)^{0{,}16} = 0{,}604$

$G_{c2} = (0{,}36 \times 0{,}36 \times 0{,}24 \times 0{,}48 \times 0{,}36 \times 0{,}36)^{0{,}16} = 0{,}368$

$G_{c3} = (0{,}24 \times 0{,}16 \times 0{,}24 \times 0{,}32 \times 0{,}16 \times 0{,}24)^{0{,}16} = 0{,}234$

$G_{c4} = (0{,}15 \times 0{,}15 \times 0{,}10 \times 0{,}15 \times 0{,}20 \times 0{,}15)^{0{,}16} = 0{,}159$

$G_{c5} = (0.09 \times 0{,}06 \times 0{,}06 \times 0{,}12 \times 0{,}12 \times 0{,}09)^{0{,}16} = 0{,}095$

$G_{c6} = (0{,}03 \times 0{,}03 \times 0{,}45 \times 0{,}45 \times 0{,}03 \times 0{,}06)^{0{,}16} = 0{,}044$

Table 5. G Limit Approximate Value

	C_1	C_2	C_3	C_4	C_5	C_6
G	0,604	0,368	0,234	0,159	0,095	0,044

5. Calculation of matrix elements of alternative distance from the border approximate area (Q)

Q = V - G

Criteria (C_1)

$Q_{11} = 0{,}615 – 0{,}604 = 0{,}011$

$Q_{21} = 0{,}41 – 0{,}604 = - 0{,}194$

$Q_{31} = 0{,}41 – 0{,}604 = - 0{,}194$

$Q_{41} = 0{,}82 – 0{,}604 = - 0{,}216$

$Q_{51} = 0{,}655 – 0{,}604 = 0{,}011$

$Q_{61} = 0{,}82 – 0{,}604 = 0{,}216$

Criteria (C_2)

$Q_{12} = 0{,}36 – 0{,}368 = - 0{,}008$

$Q_{22} = 0{,}36 – 0{,}368 = - 0{,}008$

$Q_{32} = 0{,}24 – 0{,}368 = - 0{,}128$

$Q_{42} = 0{,}48 – 0{,}368 = 0{,}112$

$Q_{52} = 0{,}36 – 0{,}368 = - 0{,}008$

$Q_{62} = 0{,}36 – 0{,}368 = - 0{,}008$

Criteria (C_3)

$Q_{13} = 0{,}24 – 0{,}234 = 0{,}006$

$Q_{23} = 0{,}16 – 0{,}234 = - 0{,}074$

Q_{33} = 0,24 – 0,234 = 0,006

Q_{43} = 0,32 – 0,234 = 0,086

Q_{53} = 0,16 – 0,234 = - 0,074

Q_{63} = 0,24 – 0,234 = 0,006

Criteria (C_4)

Q_{14} = 0,15 – 0,159 = - 0,009

Q_{24} = 0,15 – 0,159 = - 0,009

Q_{34} = 0,10 – 0,159 = - 0,059

Q_{44} = 0,15 – 0,159 = - 0,009

Q_{54} = 0,20 – 0,159 = 0,041

Q_{64} = 0,15 – 0,159 = - 0,009

Criteria (C_5)

Q_{15} = 0,09 – 0,095 = - 0,005

Q_{25} = 0,06 – 0,095 = - 0,035

Q_{35} = 0,06 – 0,095 = - 0,035

Q_{45} = 0,12 – 0,095 = 0,025

Q_{55} = 0,12 – 0,095 = 0,025

Q_{65} = 0,09 – 0,095 = - 0,005

Criteria (C_6)

Q_{16} = 0,03 – 0,044 = - 0,014

Q_{26} = 0,03 – 0,044 = - 0,014

Q_{36} = 0,45 – 0,044 = 0,001

Q_{46} = 0,45 – 0,044 = 0,001

Q_{56} = 0,03 – 0,044 = - 0,014

Q_{66} = 0,06 – 0,044 = 0,016

$$Q = \begin{bmatrix} 0{,}011 & -0{,}008 & 0{,}006 & -0{,}009 & -0{,}005 & -0{,}014 \\ -0{,}194 & -0{,}008 & -0{,}074 & -0{,}009 & -0{,}035 & -0{,}014 \\ -0{,}194 & -0{,}128 & 0{,}006 & -0{,}059 & -0{,}035 & 0{,}001 \\ 0{,}216 & 0{,}112 & 0{,}086 & -0{,}009 & 0{,}025 & 0{,}001 \\ 0{,}011 & -0{,}008 & -0{,}074 & 0{,}041 & 0{,}025 & -0{,}014 \\ 0{,}216 & -0{,}008 & 0{,}006 & -0{,}009 & -0{,}005 & 0{,}016 \end{bmatrix}$$

6. Ranking alternatives (S)

S_1 = 0,011 + (-0,008) + 0,006 + (-0,009) + (-0,005) + (-0,014)

= - 0,019

S_2 = (-0,194) + (-0,008)+(-0,074)+(-0,009)+(-0,035)+(-0,014)

= - 0,334

S_3 = (-0,194) + (-0,128)+ 0,006 + (-0,059)+(-0,035)+0,001

= - 0,409

S_4 = 0,216 + 0,112 + 0,086 + (-0,009) + 0,025 + 0,001

= 0,431

S_5 = 0,011 + (-0,008) + (-0,074) + 0,041 + 0,025 + (-0,014)

= - 0,019

S_6 = 0,216 + (-0,008) +0,006 + (-0,009) + (-0,005) + 0,016

= 0,216

7. Ranking results

Table 6. Rangking Result

No	Alternative	Q → S	Rank
1	Karin(A4)	0,431	1
2	Cinta (A6)	0,216	2
3	Maya (A5)	-0,019	3
4	Sinta (A1)	-0,019	4
5	Gisal (A2)	-0,334	5
6	Voli(A3)	-0,409	6

Looking at the table above, as its highest value is for Karen A4 in the first position and Cinta A6 in the second position, it becomes the best alternative.

b. *MOORA* (Multi-Objective Optimization on the basis of Ratio Analysis)

1. Create a Decision Matrix

$$X = \begin{bmatrix} 2 & 2 & 2 & 2 & 2 & 3 \\ 1 & 2 & 1 & 2 & 1 & 3 \\ 1 & 1 & 2 & 1 & 1 & 2 \\ 3 & 3 & 3 & 2 & 3 & 2 \\ 2 & 2 & 1 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 & 2 & 1 \end{bmatrix}$$

2. Normalization on *MOORA* method

Criteria C1

$= \sqrt{2^2 + 1^2 + 1^2 + 3^2 + 2^2 + 3^2}$

$= 5{,}09$

$A_{11} = \frac{2}{5{,}09} = 0{,}39$

$A_{21} = \frac{1}{5{,}09} = 0{,}19$

$A_{31} = \frac{1}{5{,}09} = 0{,}19$

$A_{41} = \frac{3}{5{,}09} = 0{,}58$

$A_{51} = \frac{2}{5{,}09} = 0{,}39$

$A_{61} = \frac{3}{5{,}09} = 0{,}58$

Criteria C2

$= \sqrt{2^2 + 2^2 + 1^2 + 3^2 + 2^2 + 2^2}$

$= 5{,}09$

$A_{12} = \frac{2}{5{,}09} = 0{,}39$

$A_{22} = \frac{2}{5{,}09} = 0{,}39$

$A_{32} = \frac{1}{5.09} = 0{,}19$

$A_{42} = \frac{3}{5{,}09} = 0{,}58$

$A_{52} = \frac{2}{5{,}09} = 0{,}39$

$A_{62} = \frac{2}{5{,}09} = 0{,}39$

Criteria C3

$= \sqrt{2^2 + 1^2 + 2^2 + 3^2 + 1^2 + 2^2}$

$= 4{,}5$

$A_{13} = \frac{2}{4{,}5} = 0{,}39$

$A_{23} = \frac{1}{4{,}5} = 0{,}19$

$A_{33} = \frac{2}{4{,}5} = 0{,}19$

$A_{43} = \frac{3}{4{,}5} = 0{,}58$

$A_{53} = \frac{1}{4{,}5} = 0{,}39$

$A_{63} = \frac{2}{4{,}5} = 0{,}58$

Criteria C4

$= \sqrt{2^2 + 2^2 + 1^2 + 2^2 + 3^2 + 2^2}$

$= 5$

$A_{14} = \frac{2}{5} = 0{,}4$

$A_{24} = \frac{2}{5} = 0{,}4$

$A_{34} = \frac{1}{5} = 0{,}2$
$A_{44} = \frac{2}{5} = 0{,}4$
$A_{54} = \frac{3}{5} = 0{,}6$
$A_{64} = \frac{2}{5} = 0{,}4$

Criteria C5
$= \sqrt{2^2 + 1^2 + 1^2 + 3^2 + 2^2 + 3^2}$
$= 4{,}6$
$A_{15} = \frac{2}{4{,}6} = 0{,}46$
$A_{25} = \frac{1}{4{,}6} = 0{,}21$
$A_{35} = \frac{1}{4{,}6} = 0{,}21$
$A_{45} = \frac{3}{4{,}6} = 0{,}65$
$A_{55} = \frac{2}{4{,}6} = 0{,}65$
$A_{65} = \frac{3}{4{,}6} = 0{,}46$

Criteria C6
$= \sqrt{3 + 3^2 + 2^2 + 2^2 + 3^2 + 1^2}$
$= 6$
$A_{16} = \frac{3}{6} = 0{,}5$
$A_{26} = \frac{3}{6} = 0{,}5$
$A_{36} = \frac{2}{6} = 0{,}3$
$A_{46} = \frac{2}{6} = 0{,}3$
$A_{56} = \frac{3}{6} = 0{,}5$
$A_{66} = \frac{1}{6} = 0{,}16$

Normalization Result

$$X_{\mathrm{ij}} = \begin{bmatrix} 0{,}39 & 0{,}39 & 0{,}4 & 0{,}4 & 0{,}46 & 0{,}5 \\ 0{,}19 & 0{,}39 & 0{,}2 & 0{,}4 & 0{,}21 & 0{,}5 \\ 0{,}19 & 0{,}19 & 0{,}4 & 0{,}2 & 0{,}21 & 0{,}3 \\ 0{,}58 & 0{,}58 & 0{,}6 & 0{,}4 & 0{,}65 & 0{,}3 \\ 0{,}39 & 0{,}39 & 0{,}2 & 0{,}6 & 0{,}65 & 0{,}5 \\ 0{,}58 & 0{,}39 & 0{,}4 & 0{,}4 & 0{,}46 & 0{,}16 \end{bmatrix}$$

3. Optimizing attribute values.
   The normalization result is multiplied by W_{ij}

$$\begin{bmatrix} 0{,}160 & 0{,}093 & 0{,}064 & 0{,}4 & 0{,}027 & 0{,}015 \\ 0{,}077 & 0{,}093 & 0{,}032 & 0{,}4 & 0{,}012 & 0{,}015 \\ 0{,}077 & 0{,}045 & 0{,}064 & 0{,}2 & 0{,}012 & 0{,}009 \\ 0{,}237 & 0{,}139 & 0{,}096 & 0{,}4 & 0{,}039 & 0{,}009 \\ 0{,}160 & 0{,}093 & 0{,}032 & 0{,}6 & 0{,}039 & 0{,}015 \\ 0{,}237 & 0{,}093 & 0{,}064 & 0{,}4 & 0{,}027 & 0{,}004 \end{bmatrix}$$

4. Determining the YI Value Using Equation
5.

Table 7. Determining the YI Value Using Equation

No	Alternative	Maximum (C1+C2+C3+C4+C5)	Minimum (C6)	YI (Max-Min)	Rank
1	A1	0,399	0,015	0,384	3
2	A2	0,269	0,015	0,254	5
3	A3	0,227	0,009	0,218	6
4	A4	0,56	0,009	0,47	1
5	A5	0,399	0,015	0,384	4
6	A6	0,465	0,004	0,461	2

From the table above, it can be seen that the Greatest Value is in A4 = 0.47 and A6 = 0.461 so Karin and Cinta are the Alternatives as the best Alternatives. In other words, Karin and Cinta are selected as the best Honorary staff performance values.

c. ARAS (Additive Ratio Assessment)

DECISION SUPPORT SYSTEM FOR LECTURER PERFORMANCE ASSESSMENT USING ADDITIVE RATIO ARRESSMENT (*ARAS*) METHOD

Matriks

$$X = (x:)) \begin{bmatrix} 2 & 2 & 2 & 2 & 2 & 3 \\ 1 & 2 & 1 & 2 & 1 & 3 \\ 1 & 1 & 2 & 1 & 1 & 2 \\ 3 & 3 & 3 & 2 & 3 & 2 \\ 2 & 2 & 1 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 & 2 & 1 \\ 12 & 12 & 11 & 12 & 12 & 10 \end{bmatrix}$$

$$Xij = \frac{Xij}{\sum^{m}_{i=0} Xij}$$

Table 8. Normalize Decision Matrices for All Criteria

C1	C3	C5
R01 = $\frac{2}{12}$ = 6	R03 = $\frac{2}{11}$ = 0,18	R05 = $\frac{2}{12}$ = 6
R11 = $\frac{2}{12}$ = 12	R13 = $\frac{1}{11}$ = 11	R15 = $\frac{1}{12}$ = 12
R21 = $\frac{1}{12}$ = 12	R23 = $\frac{2}{11}$ = 0,18	R25 = $\frac{1}{12}$ = 12

R31 = $\frac{3}{12}$ = 4	R33 = $\frac{3}{11}$ = 0,27	R35 = $\frac{3}{12}$ = 4
R41 =$\frac{2}{12}$ = 6	R43 = $\frac{1}{11}$ = 11	R45 = $\frac{3}{12}$ = 4
R51 = $\frac{3}{12}$ = 4	R53 = $\frac{2}{11}$ = 0,8	R55 = $\frac{2}{12}$ = 6

Table 9. Normalize Decision Matrices for All Criteria

C2	C4	C6
R02 =$\frac{2}{12}$ = 6	R04 = = 6	R06 = $\frac{3}{14}$ = 0,21
R12 = $\frac{2}{12}$ = 6	R04 = $\frac{2}{12}$ = 6	R16 = $\frac{3}{14}$ = 0,2
R22 = $\frac{1}{12}$ = 12	R24 = $\frac{2}{12}$ = 12	R26 = $\frac{2}{14}$ = 127
R32 = $\frac{3}{12}$ = 4	R34 = $\frac{2}{12}$ = 6	R36 = $\frac{2}{14}$ = 7
R42 = $\frac{2}{12}$ = 6	R44 = $\frac{3}{12}$ = 4	R46 = $\frac{3}{14}$ = 0,4
R52 = $\frac{2}{12}$ = 6	R54 = $\frac{2}{12}$ = 6	R56 = $\frac{1}{14}$ = 14

From the above calculations obtained matrix

$$\begin{bmatrix} 6 & 6 & 0{,}18 & 6 & 6 & 0{,}21 \\ 12 & 6 & 11 & 6 & 12 & 0{,}2 \\ 12 & 12 & 0{,}18 & 12 & 12 & 7 \\ 4 & 4 & 0{,}27 & 6 & 4 & 7 \\ 6 & 6 & 11 & 4 & 4 & 0{,}4 \\ 4 & 6 & 0{,}8 & 6 & 6 & 14 \end{bmatrix}$$

Determine the value of the optimization function by adding up the criteria values for each alternative with the weights that have been carried out previously

S0 = 6 + 6 + 0,18 + 6 + 6 + 0,4 = 24,58

S1 = 12 + 6 + 11 + 6 + 12 + 0,2 = 47,2

S2 = 12 + 12 + 0,18 + 12 + 12 + 7 = 55,18

S3 = 4 + 4 + 0,27 + 6 + 4 + 7 = 27,27

S4 = 6 + 6 +11 + 4 + 4 + 0,4 = 31,4

S5 = 4 + 6 + 0,8 + 6 + 6 +14 = 36,8

S0 + S1 + S2 + S3 + S4 + S5 = 222, 43

Determine the highest ranking level of each alternative 0(An)

K0 = $\frac{S1}{S0}$ = $\frac{24,58}{222,43}$ = 0,110

K1 = $\frac{S1}{S0}$ = $\frac{47,2}{222,43}$ = 0,212

K2 = $\frac{S1}{S0}$ = $\frac{55,18}{222,43}$ = 0,248

K3 = $\frac{S1}{S0}$ = $\frac{27,27}{222,43}$ = 0,122

K4 = $\frac{S1}{S0}$ = $\frac{31,4}{222,43}$ = 0,141

K5 = $\frac{S1}{S0}$ = $\frac{36,8}{222,43}$ = 0,165

CONCLUSIONS AND RECOMMENDATIONS

The method used by the author in the Decision Support System is the Additive Ratio Assessment (*ARAS*) method, because it is easier to determine the best alternative and produces more optimal solutions or decisions in each calculation. in determining the optimization function by adding up the criteria values for each alternative with the weights that have been carried out previously. Based on the ranking value above, alternative 2 or K2 has a high ranking level and shows that this alternative is a solution that is close to the ideal solution and far from a negative solution. So alternative K2 can be considered as the optimal solution.

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