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THE COMPARISON OF WASPAS AND VIKOR METHODS IN ASSESSMENT OF LECTURER PERFORMANCE

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ABSTRACT

Lecturers are valuable assets in a university, both public and private. A good university must have lecturers who are experts in their fields. Therefore lecturers' evaluation performance needs to be done routinely to make sure lecturers have carried out their duties and responsibilities well. The results of the lecturer performance appraisal are used to consider the leadership to develop the lecturer career.This research aims to compare evaluation performance with the Weight Aggregated Sum Product Assessment (WASPAS) and Vise Kriterijumska Optimizajica I Kompromisno Resenje (VIKOR) method. The object of his research is the decision support system for the lecturers' performance evaluation. The results of his research showed that in evaluating the performance of lecturers using the WASPAS and VIKOR methods the same results were obtained for the best ranking, A10, but there were differences in the results for the next ranking.

INTRODUCTION

Lecturers are professional teaching staff and scientists whose job is to transform, develop and disseminate science, technology, and arts through the fields of education, research, and community service. [1] Lecturers as a transfer of higher education are valuable human resources for public and private universities [2]. Based on this, it is very important to assess the performance of lecturers in the teaching and learning process.

Performance appraisal can be defined as an ongoing process used to identify, measure, and develop individual performance in accordance with the strategic objectives of the organization [3]. Lecturer performance evaluation is one of the activities carried out in each tertiary institution which aims to evaluate the performance of every lecturer in tertiary institutions. The purpose of evaluating the performance of lecturers is to evaluate the performance of lecturers in carrying out their activities in the teaching and learning process.

STMIK Royal is a private tertiary institution located in the city of Kisaran. At STMIK Royal, the performance evaluation of lecturers is carried out by the Quality Assurance Institute. as an institution that guarantees the quality of higher education. The

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performance evaluation of lecturers is carried out 2 times, which is at the end of each odd and even semester. The process of assessing lecturers is assessed by students with 4 aspects, namely pedagogical aspects, professional aspects, personality aspects, and social aspects [4]. The results of this assessment will be used as evaluation material in the selection of lecturers with the best performance. To assist in the assessment process, a system that is able to make decisions in the performance evaluation of lecturers is needed.

Decision support system is a computer-based system that can solve problems in producing the best alternative. The application of a decision support system can help management in producing effective decisions can be seen in previous research. For example, a study by Daniawan (2018) who conducted a research evaluation of teaching performance of lecturers using the AHP and SAW methods [5] to make recommendations for selecting the best lecturers [6]. In addition to these two methods, many other decision support system methods can be used, such as WASPAS [7], TOPSIS [8], [9], MOORA [10], ELECTRE [7], PSI, [11] and VIKOR [12], [13].

In this research, the method used in the decision making process of lecturer performance appraisal is the WASPAS and VIKOR method [14]. The two methods were chosen because they can optimize the selection of the highest and lowest scores, and are expected to produce an objective decision in evaluating lecturer performance, so that this decision can be used as a reference to get the best lecturer.

METHOD

Decision Support System is a computer-based information system that produces various alternative decisions to help management deal with various structured or unstructured problems using data and models. It can be concluded that the Decision Support System is a specific information system that helps managers produce alternative decisions in solving the problems they face [7].

Weight Aggregated Sum Product Assessment (WASPAS) is a method that can reduce errors or optimize the assessment for the selection of the highest and lowest values [15].

The steps in the calculation process by applying the WASPAS method, namely [16], [17], [18]:

Step 1 : Make a Decision Matrix

$$X = \begin{bmatrix} x_{11} & x_{12}\cdots & x_{1n} \\ x_{21} & x_{22}\cdots & x_{2n} \\ \cdots & \cdots & \cdots \quad \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}$$

Where n is the number of evaluation criteria, m is the number of alternatives and x_{ij} is the alternative performance with respect to criteria j.

Step 2 : Normalize Matrix x

If the benefits criteria, then:

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$$x_{ij} = \frac{x_{ij}}{max_i x_{ij}} \quad (1)$$

If the cost criteria, then:

$$x_{ij} = \frac{min_i x_{ij}}{x_{ij}} \quad (2)$$

Step 3 : Calculate the Preference Value (Qi)

$$Q_i = 0{,}5 \sum_{j=1}^{n} x_{ij}\, w + 0{,}5 \prod_{j=1}^{n} (x_{ij})^{wj} \quad (3)$$

Where Q_i is the value from Q to i, $x_{ij}\, w$ is the multiplication of the value x_{ij} with a weight of w, while 0.5 is the provision. The best alternative is the alternative that has the highest Q_i value.

Vise Kriterijumska Optimizajica I Kompromisno Resenje (VIKOR), which means multi-criteria optimization and compromise solution, is one of many Multi-Criteria Decision Making (MCDM) techniques. VIKOR is an MCDM method that can rank [19].

The strengths of the VIKOR method, namely the VIKOR method, are alternative ranking based on the closest to the Positive Ideal Solution (PIS) and the farthest from the Negative Ideal Solution (NIS). Besides, the best alternative is chosen from the maximum utility group and the minimum regret group.

The VIKOR algorithm has the following steps :

Step 1 : Normalize using the following formula:

$$R_{ij} = \left(\frac{x_{j+} - x_{ij}}{x_{j+} - x_{j-}} \right) \quad (4)$$

Where Rij and Xij (i = 1,2,3, ..., m and j = 1,2,3, ..., n) are elements of the decision making matrix (alternative i to the criteria j) and x_{j+} is the highest element of the criterion j, x_{j-} is the lowest element of the criterion j.

Step 2 : Calculate the S and R values using the formula:

$$S_i = \sum_{j=1}^{n} W_j \left(\frac{x_{j+} - x_{ij}}{x_{j+} - x_{j-}} \right) \quad (5)$$

and

$$R_i = Max_j \left[W_j \left(\frac{x_{j+} - x_{ij}}{x_{j+} - x_{j-}} \right) \right] \quad (6)$$

Where Wj is the weight of each criterion j.

Step 3 : Determine the index value

$$Q_i = \left[\frac{S_i - S^+}{S^- - S^+} \right] V + \left[\frac{R_i - R^+}{R^- - R^+} \right] (1 - V) \quad (7)$$

Where S = max Si, S + = min Si and R- = Max Ri, R + = Min Ri and V = 0.5.

Step 4 : Ranking results are the results of sequencing from S, R, Q.

Step 5 : The best alternative ranking solution based on the minimum Q value becomes the best rating on condition:

$$Q\left(A^{(2)}\right) - Q\left(A^{(1)}\right) \geq DQ \quad (8)$$

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Where $A^{(2)}$ = alternative with second-order in ranking Q and $A^{(1)}$ = alternative with the best order in ranking Q while DQ = 1- (m-1), where m is the number of alternatives. Alternative $A^{(1)}$ must be in the best rank on S and/or R.

RESULT AND DISCUSSION

In evaluating the performance of lecturers needed a system that can help in making decisions to determine the lecturer with the best performance. To ease the work of the Chairman of the STMIK Royal Quality Assurance Institute in evaluating lecturer performance. In this study, the criteria used in evaluating lecturer performance are pedagogical aspects, professional aspects, personality aspects, and social aspects. As for the alternatives used, it can be seen in Table 1.

Table 1. Alternative

No.	Alternative	Name	No.	Alternative	Name
1	A_1	Hommy	8	A_8	Yessica
2	A_2	Hambali	9	A_9	Sumantri
3	A_3	Romy Aulia	10	A_{10}	Jeperson
4	A_4	Suparmadi	11	A_{11}	Dewi Anggraini
5	A_5	Nasrun Marpaung	12	A_{12}	Moh. Siddiq
6	A_6	Nurkarim Nehe	13	A_{13}	Ari Dermawan
7	A_7	Rizaldi	14	A_{14}	Afdal Asnur

Each criterion has a different weight, adjusted to the level. For more details, can be seen in table 2.

Table 2. Criteria

Criteria	Information	Weight	Type
C_1	Pedagogical aspects	40%	Benefit
C_2	Professional aspects	30%	Benefit
C_3	Personality aspects	20%	Benefit
C_4	Social aspects	10%	Benefit

Table 3. Criteria Value for Each Alternative

Alternative	Criteria			
	C_1	C_2	C_3	C_4
A_1	4,27	4,38	4,48	4,25
A_2	4,58	4,84	4,88	4,85
A_3	3,42	3,19	3,46	3,30
A_4	2,70	3,33	3,94	3,87
A_5	4,50	4,20	4,65	4,33
A_6	4,00	3,63	4,33	4,00
A_7	3,37	3,29	3,44	3,20
A_8	3,00	2,63	2,83	2,80
A_9	4,27	4,25	4,50	4,33
A_{10}	4,78	4,68	4,90	4,64

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Table 3. Criteria Value for Each Alternative

Alternative	Criteria			
	C_1	C_2	C_3	C_4
A_{11}	4,89	4,75	4,83	4,00
A_{12}	3,94	3,50	3,83	4,40
A_{13}	4,58	4,72	4,71	4,70
A_{14}	4,33	4,75	5,00	5,00
Max	4,89	4,84	5,00	5,00
Min	2,70	2,63	2,83	2,80
Weight	0,40	0,30	0,20	0,10

Calculation of WASPAS Method

- Making a Decision Matrix

$$X = \begin{bmatrix} 4,27 & 4,38 & 4,48 & 4,25 \\ 4,58 & 4,84 & 4,88 & 4,85 \\ 3,42 & 3,19 & 3,46 & 3,30 \\ 2,70 & 3,33 & 3,94 & 3,87 \\ 4,50 & 4,20 & 4,65 & 4,33 \\ 4,00 & 3,63 & 4,33 & 4,00 \\ 3,37 & 3,29 & 3,44 & 3,20 \\ 3,00 & 2,63 & 2,83 & 2,80 \\ 4,27 & 4,25 & 4,50 & 4,33 \\ 4,78 & 4,68 & 4,90 & 4,64 \\ 4,89 & 4,75 & 4,83 & 4,00 \\ 3,94 & 3,50 & 3,83 & 4,40 \\ 4,58 & 4,72 & 4,71 & 4,70 \\ 4,33 & 4,75 & 5,00 & 5,00 \end{bmatrix}$$

- Calculating the Normalized Matrix
  Since all criteria are benefits, normalization of x material uses equation (1):

$$X_{11} = {}^{4,27}/_{4,89} = 0,87$$
$$X_{12} = {}^{4,38}/_{4,84} = 0,90$$
$$X_{13} = {}^{4,48}/_{5,00} = 0,90$$
$$X_{14} = {}^{4,25}/_{5,00} = 0,85$$

  Use the same method for subsequent calculations, the results obtained from these calculations can be seen in the following matrix:

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$$X = \begin{bmatrix} 0,87 & 0,90 & 0,90 & 0,85 \\ 0,94 & 1,00 & 0,98 & 0,97 \\ 0,70 & 0,66 & 0,69 & 0,66 \\ 0,55 & 0,69 & 0,79 & 0,77 \\ 0,92 & 0,87 & 0,93 & 0,87 \\ 0,82 & 0,75 & 0,87 & 0,80 \\ 0,69 & 0,68 & 0,69 & 0,64 \\ 0,61 & 0,54 & 0,57 & 0,56 \\ 0,87 & 0,88 & 0,90 & 0,87 \\ 0,98 & 0,97 & 0,98 & 0,93 \\ 1,00 & 0,98 & 0,97 & 0,80 \\ 0,81 & 0,72 & 0,77 & 0,88 \\ 0,94 & 0,97 & 0,94 & 0,94 \\ 0,89 & 0,98 & 1,00 & 1,00 \end{bmatrix}$$

Calculate preference values using equation (3):

$$Q_1 = 0,5 \sum((0,87 * 0,40) + (0,90 * 0,30) + (0,90 * 0,20) + (0,85 * 0,10)) + 0,5 \prod((0,87)^{0,40} * (0,90)^{0,30} * (0,90)^{0,20} * (0,85)^{0,10})$$

$$= \mathbf{0,5} \sum(\mathbf{0,348 + 0,27 + 0,18 + 0,085}) + \mathbf{0,5} \prod(\mathbf{0,95 * 0,97 * 0,98 * 0,98})$$

$$= 0,5 * 0,883 + 0,5 * 0,885$$

$$= 0,884$$

Perform calculations in the same way to look for Q_2 to Q_{14}, then ranking values using the WASPAS method can be generated in table 4.

Table 4. WASPAS Method Ranking Results

Alternative	Q_i	Ranking
A_{10}	0,969	1
A_2	0,967	2
A_{11}	0,967	3
A_{13}	0,949	4
A_{14}	0,948	5
A_5	0,900	6
A_1	0,884	7
A_9	0,879	8
A_6	0,804	9
A_{12}	0,780	10
A_3	0,681	11
A_7	0,681	12
A_4	0,659	13
A_8	0,577	14

From table 4, the highest value of decision can be taken is A_{10} as the best performing lecturer.

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Calculation of the VIKOR Method

- Normalize with equation (4)
  Alternative A_1

$$R_{11} = \left(\frac{4{,}89 - 4{,}27}{4{,}89 - 2{,}70}\right) = 0{,}285$$
$$R_{12} = \left(\frac{4{,}84 - 4{,}38}{4{,}84 - 2{,}63}\right) = 0{,}211$$
$$R_{13} = \left(\frac{5{,}00 - 4{,}48}{5{,}00 - 2{,}83}\right) = 0{,}240$$
$$R_{14} = \left(\frac{5{,}00 - 4{,}25}{5{,}00 - 2{,}80}\right) = 0{,}342$$

  Use the same method for other alternative calculations, the results obtained from these calculations can be seen in the following matrix.

$$\boldsymbol{R_{ij}} = \begin{bmatrix} \mathbf{0,285} & \mathbf{0,211} & \mathbf{0,240} & \mathbf{0,342} \\ \mathbf{0,140} & \mathbf{0,000} & \mathbf{0,058} & \mathbf{0,068} \\ \mathbf{0,674} & \mathbf{0,746} & \mathbf{0,712} & \mathbf{0,773} \\ \mathbf{1,000} & \mathbf{0,682} & \mathbf{0,487} & \mathbf{0,515} \\ \mathbf{0,178} & \mathbf{0,292} & \mathbf{0,162} & \mathbf{0,305} \\ \mathbf{0,407} & \mathbf{0,549} & \mathbf{0,308} & \mathbf{0,455} \\ \mathbf{0,695} & \mathbf{0,700} & \mathbf{0,718} & \mathbf{0,818} \\ \mathbf{0,865} & \mathbf{1,000} & \mathbf{1,000} & \mathbf{1,000} \\ \mathbf{0,283} & \mathbf{0,268} & \mathbf{0,231} & \mathbf{0,303} \\ \mathbf{0,050} & \mathbf{0,076} & \mathbf{0,046} & \mathbf{0,164} \\ \mathbf{0,000} & \mathbf{0,042} & \mathbf{0,077} & \mathbf{0,455} \\ \mathbf{0,435} & \mathbf{0,606} & \mathbf{0,538} & \mathbf{0,273} \\ \mathbf{0,140} & \mathbf{0,056} & \mathbf{0,135} & \mathbf{0,136} \\ \mathbf{0,256} & \mathbf{0,042} & \mathbf{0,000} & \mathbf{0,000} \end{bmatrix}$$

- Calculates the values of S and R
  To calculate the value of S, use equation (5).

$$S_1 = \sum (0{,}285 * 0{,}40) + (0{,}211 * 0{,}30) + (0{,}240 * 0{,}20) + (0{,}342 * 0{,}10)$$
$$= 0{,}114 + 0{,}063 + 0{,}048 + 0{,}034$$
$$= 0{,}259$$

  To find the value of R use equation (6), where the maximum value of (0.114, 0.063, 0.048, and 0.034) is 0.114. For clarity, the values of S and R can be seen in table 5.

Table 5. S and R values

No.	Alternative	S	R
1	A_1	0,259	0,114
2	A_2	0,075	0,056
3	A_3	0,713	0,270
4	A_4	0,754	0,400
5	A_5	0,222	0,088
6	A_6	0,435	0,165
7	A_7	0,713	0,278
8	A_8	0,946	0,346

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Table 5. S and R values

No.	Alternative	S	R
9	A_9	0,270	0,113
10	A_{10}	0,069	0,023
11	A_{11}	0,074	0,045
12	A_{12}	0,490	0,182
13	A_{13}	0,114	0,056
14	A_{14}	0,115	0,102

- Determine the Index Value
  $S^- = 0,946$ $R^- = 0,400$
  $S^+ = 0,069$ $R^+ = 0,023$
  The next step is to calculate the value of Qi using the 6th equation.
  Where V = 0.5.

$$Q_1 = \left[\frac{0,259 - 0,069}{0,946 - 0,069}\right] 0,5 + \left[\frac{0,114 - 0,023}{0,400 - 0,023}\right] (1 - 0,5) = 0,229$$
$$Q_2 = \left[\frac{0,075 - 0,069}{0,946 - 0,069}\right] 0,5 + \left[\frac{0,056 - 0,023}{0,400 - 0,023}\right] (1 - 0,5) = 0,048$$
$$Q_3 = \left[\frac{0,713 - 0,069}{0,946 - 0,069}\right] 0,5 + \left[\frac{0,270 - 0,023}{0,400 - 0,023}\right] (1 - 0,5) = 0,694$$
$$Q_4 = \left[\frac{0,754 - 0,069}{0,946 - 0,069}\right] 0,5 + \left[\frac{0,400 - 0,023}{0,400 - 0,023}\right] (1 - 0,5) = 0,890$$
$$Q_5 = \left[\frac{0,222 - 0,069}{0,946 - 0,069}\right] 0,5 + \left[\frac{0,088 - 0,023}{0,400 - 0,023}\right] (1 - 0,5) = 0,173$$

Here is a table of alternative ranking results from lowest to highest.

Table 6. VIKOR Method Ranking Results

Alternative	Q_i	Ranking
A_{10}	0,000	1
A_{11}	0,033	2
A_2	0,048	3
A_{13}	0,070	4
A_{14}	0,132	5
A_5	0,173	6
A_1	0,229	7
A_9	0,234	8
A_6	0,397	9
A_{12}	0,451	10
A_3	0,694	11
A_7	0,706	12
A_4	0,890	13
A_8	0,928	14

From the ranking table, it was obtained that A10 was the highest ranking with 0,000 results.

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CONCLUSION

From the results of the analysis and discussion that has been done, it can be concluded that in evaluating the performance of lecturers using the WASPAS and VIKOR methods get the same results for the best ranking of A10, but for ranks 2 and 3 there are differences. In WASPAS calculations, ranks 2 and 3 have the same value, so it is difficult to determine the ranking, while the VIKOR method calculation is obtained in accordance with the lowest to highest value. Therefore the VIKOR method is more accurate in determining the ranking for evaluating lecturer performance.

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