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Comparison of MAUT Method with WASPAS Method in IBN Lecturer Performance Assessment

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Abstract: Lecturers are educators in higher education institutions. The role of a lecturer is very influential on the quality of education in a university, both State Universities (bahasa: Perguruan Tinggi Negeri (PTN)) or Private Universities (bahasa: Perguruan Tinggi Swasta (PTS)). With the assessment of lecturer performance, certain assessments are created to be used as a benchmark for the ability/quality/value of a lecturer at a university. In this study, researchers compare the MAUT method and the WASPAS method which will provide an alternative answer that is more accurate while at the same time knowing which method is the best between the two methods, as well as to be used by universities in determining the most influential factors in determining the quality of a person's performance lecturer. Comparing the two methods will get an appropriate method in determining the performance of lecturers in a university.

Keywords: Performance, Lecturer, Comparison, MAUT, WASPAS.

1. INTRODUCTION

The teaching and learning process in a state university or private university is inseparable from the role of an educator or lecturer. In tertiary institutions, lecturers act as educators and have the task of planning and implementing the teaching and learning process, assessing learning outcomes, conducting guidance and training, as well as conducting research and community service by becoming educators to educate the nation's life. Based on the Law of the Republic of Indonesia No. 14 of 2005 concerning Teachers and Lecturers, Article 51 paragraph (1) Point b, that lecturers are entitled to promotions and awards according to their academic performance. With an award for academic performance. With the award for Lecturer performance, it is hoped that it can increase motivation among lecturers which will certainly have an impact on the development of academic management in higher education. So it is appropriate that every university can give awards to lecturers who have proud achievements for their universities. The award system for lecturers is implemented by

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implementing the lecturers by selecting outstanding lecturers. The selection process for outstanding lecturers cannot be separated from the Lecturer Workload (BKD) evaluation process which must have been carried out previously because one of the criteria for selecting outstanding lecturers is a requirement to be involved in the selection of outstanding lecturers.
Universities in determining the performance of lecturers often use inappropriate methods, so that the results obtained are less accurate and often cause problems. Researchers here will compare the methods that are often used in determining the performance of lecturers with other methods, in this study compare the MAUT method and the WASPAS method. With this comparison, more accurate results will be obtained in determining the method to determine lecturer performance.

2. LITERATURE REVIEW

2.1. WASPAS Method

Weight Aggregated Sum Product Assessment (WASPAS) is to find the priority of alternative choices that are most suitable by using weighting. The application of the WASPAS method is one of the methods used to minimize the defects of a result in the search for results to find out the highest and smallest values. With the WASPAS method, the optimum combination criteria are sought based on two optimum criteria. The first criterion is the maximum, the achievement of the criteria with the average is evenly divided using the WSM method. This is a familiar and adopted approach used in MCDM which is used to evaluate several alternatives in several decision criteria [1].
WASPAS (Weighted Aggregated Sum Product Assessment) is a method in a decision support system that is used to find appropriate priorities by using weighting [2].
WASPAS is a method that can reduce errors or optimize the estimation for the selection of the highest and lowest values. Thus, the main objective of the MCDM approach is to select the best option from a set of alternatives in the presence of various conflicting criteria. In this paper, an attempt is made [3].

2.2. MAUT Method

The MAUT method is capable of processing Lecturer data by producing decisions in the form of lecturers who have good and bad performance [4]. Multi Attribute Utility Theory (MAUT) is a scheme in which the final evaluation, v(x) of an object x is defined as a weight that is added up with a value relevant to its dimension value [5]. The MAUT method is a part of the Multi-Criteria Decision Making method in DSS. In recent years, the MAUT method of decision analysis has been applied by a leader to help analyze the decisions made [6].

2.3. Performance

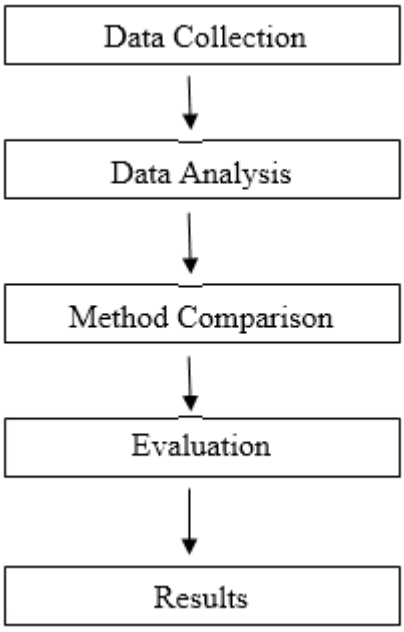
Performance is a way of measuring the contributions of individuals in the agency that is carried out to the organization. The important value of performance appraisal is that which involves determining the level of individual contributions or performance expressed in completing the tasks for which they are responsible [5].

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3. RESEARCH METHODS

3.1. Research Stage



1. **Data collection**

In this study the data were obtained by means of observation, literature study and interviews. Data collection is done using this method because it is very precise and fast in getting data for comparison.

2. **Data analysis**

The data that has been obtained is analyzed for each method.

3. **Method Comparison**

From the results of data analysis, each method has obtained results that will be used for comparison materials

4. **Evaluation**

The results of the comparison are scored based on the average of the values for each method.

5. **Results**

The results are the conclusions of the assessment of the two methods to be used as methods in assessing lecturer performance.

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3.2 Data Analysis

a. WASPAS

The calculation process steps apply the WASPAS (Weight Aggregated Sum Product Assessment) method, namely:

1. Create a decision matrix

$$= \begin{bmatrix} x_{11} & x_{12} & . & x_{1n} \\ x_{21} & x_{22} & . & x_{2n} \\ & & . & \\ x_{m1} & x_{m2} & . & x_{mn} \end{bmatrix} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

2. Normalize the x matrix

Benefit Criteria $= \ldots\ldots\ldots\ldots\ldots (2) \frac{x_{ij}}{Max\ ix_{ij}}$

Criteria Cost $\frac{Min\ ix_{ij}}{x_{ij}}$

3. Calculating the value of Qi

$Qi = 0.5 \sum_{j=1}^{n} xijw + 0{,}5 \prod_{j=1}^{n} (xij)^{wj}$..(4)

Where :

Qi = Value from Q to i

x_{ij}= Multiply value x_{ij} by weight (w)

0.5 = Constancy

The best alternative is the alternative that has the highest Qi value.

b. *MAUT*

Multi Attribute Utility Theory (MAUT) is a scheme in which the final evaluation, v(x) of an object x is defined as a weight that is added up with a value relevant to its dimension value. The expression commonly used to refer to it is utility value. MAUT is used to convert from multiple importance into a numeric value on a scale of 0 -1 with 0 representing the worst choice and 1 being the best. This allows direct comparison of various sizes. The end result is a ranking order of evaluations that describes the choices of the decision makers. The entire evaluation value can be defined by equation [5] .

$$V(\bar{x}) \sum_{i=1}^{n} \bar{Wj}.Xij \ldots\ldots\ldots\ldots (\bar{1})$$

Where V(x) is the evaluation value of the ith object and wi is the weight that determines the value of how important the ith element is to other elements. While n is the number of elements. The total of the weights is 1. In summary, the steps in the MAUT method are as follows [2]: 1. Break a decision into different dimensions. 2. Determine the alternative weights for each dimension. 3. List all alternatives 4. Enter the utility for each alternative according to its attributes. 5. Multiply utility by weight to determine the value of each alternative

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$$U(x) = \frac{x - xi^{-}}{xi^{+} + xi^{-}} \ldots\ldots\ldots\ldots (2)$$

Note:
U(x) = Normalized weight alt x
X = weight alt
xi $^{-}$ = Low weight from criterion to x
xi $^{+}$ = Height weight from criterion to x

1.2. Criteria and Alternatives

The criteria and alternatives used are as follows:

Criteria	Weight
C1 = Discipline	2
C2 = Tri Dharma	3
C3 = Cooperation	2
C4 = Communication	2
C5 = Contribution	1

Alternative
A1 = Adi
A2 = Eli
A3 = Cipto
A4 = Eko
A5 = Rina

Table. Evaluation

Score	
1	Very bad
2	Bad
3	Enough
4	Well
5	Very good

Table. Weighting

Criteria	**Range**	**Score**	**Note:**
Discipline	Very bad	2	Benefits
	Bad	3	
	Enough	4	
	Well	5	
	Very good		
Tri Dharma	Very bad	1	Benefits
	Bad	2	

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	Enough	3	
	Well	4	
	Very good	5	
Cooperation	Very bad	1	Benefits
	Bad	2	
	Enough	3	
	Well	4	
	Very good	5	
Communication	Very bad	5	Benefits
	Bad	3	
	Enough	1	
	Well		
	Very good		
Contribute	Very bad	1	Benefits
	Bad	2	
	Enough	3	
	Well	4	
	Very good	5	

4. DISCUSSION

4.1 Calculation with the MAUT Method

The assessment data on lecturers has been researched by 10 students who were given voting rights to fill out a questionnaire assessing the performance of the lecturers so far

Table. Adi Lecturer Data

RPD	kri 1	kri 2	kri 3	4	Kri 5
RPD1	4	2	1	5	2
RPD2	3	3	2	5	3
RPD3	2	4	2	5	4
RPD4	2	4	4	3	4
RPD5	2	5	5	3	5
RPD6	3	3	2	5	5
RPD7	4	4	4	5	3
RPD8	2	4	3	3	2
RPD9	3	2	5	4	2
RPD10	2	3	3	4	4
FLAT	**2.7**	**3.4**	**3.1**	**4.2**	**3.4**

Table. Eli Lecturer Data

RPD	kri 1	kri 2	kri 3	4	Kri 5
RPD1	3	4	5	3	4
RPD2	3	2	3	3	5

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RPD3	2	2	2	5	4
RPD4	2	3	4	4	2
RPD5	4	4	5	2	4
RPD6	5	5	3	2	2
RPD7	3	5	5	4	3
RPD8	5	3	4	2	5
RPD9	3	4	4	5	2
RPD10	2	3	3	4	2
FLAT	**3.2**	**3.5**	**3.8**	**3.4**	**3.3**

Table. Cipto Lecturer Data

RPD	**kri 1**	**kri 2**	**kri 3**	**4**	**Kri 5**
RPD1	5	5	4	5	3
RPD2	3	2	4	5	3
RPD3	4	5	4	5	3
RPD4	2	3	3	4	2
RPD5	5	4	3	5	4
RPD6	4	4	5	3	3
RPD7	5	4	3	5	4
RPD8	4	3	5	4	5
RPD9	3	4	3	3	3
RPD10	5	5	4	5	5
FLAT	**4**	**3.9**	**3.8**	**4.4**	**3.5**

Table. Eco Lecturer Data

RPD	**kri 1**	**kri 2**	**kri 3**	**4**	**Kri 5**
RPD1	3	4	3	3	2
RPD2	4	3	2	3	2
RPD3	4	4	4	4	4
RPD4	4	3	5	5	3
RPD5	2	5	3	2	2
RPD6	5	4	5	5	5
RPD7	4	5	3	5	5
RPD8	5	3	3	2	2
RPD9	4	4	3	5	5
RPD10	4	5	4	5	5
FLAT	**3.9**	**4**	**3.5**	**3.9**	**3.5**

Table. Rina Lecturer Data

RPD	**kri 1**	**kri 2**	**kri 3**	**4**	**Kri 5**
RPD1	2	2	3	3	2
RPD2	4	5	4	5	2
RPD3	2	2	3	4	2

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RPD4	5	5	5	5	5
RPD5	5	4	3	5	4
RPD6	5	4	3	5	4
RPD7	5	5	4	4	4
RPD8	2	2	2	3	2
RPD9	3	5	4	5	4
RPD10	4	3	4	3	3
FLAT	**3.7**	**3.7**	**3.5**	**4.2**	**3.2**

Table. Matrix Normalization and Preference Weights

Lecturer Name	**kri 1**	**kri 2**	**kri 3**	**4**	**Kri 5**
Adi	2.7	3.4	3.1	4.2	3.4
Eli	3.2	3.5	3.8	3.4	3.3
Cipto	4	3.9	3.8	4.4	3.5
EKO	3.9	4	3.5	3.9	3.5
Rina	3.7	3.7	3.5	4.2	3.2

The following is the calculation systematic for the Lecturer:

Lecturer = Adi, M.TI = (Alt 1)

Alt 1.1 = $\frac{2.7-2.7}{4-2.7}$= 0

Alt 1.2 = $\frac{3.4-3.4}{4-3.4}$= 0

Alt 1.3 = $\frac{3.1-3.1}{3.8-3.1}$= 0

Alt 1.4 = $\frac{4.2-3.4}{4.2-3.4}$= 1

Alt 1.5 = $\frac{3.4-3.2}{3.5-3.2}$= 0.666

Lecturer = Eli, M.TI = (Alt 2)

Alt 2.1 = $\frac{3.2-2.7}{4-2.7}$= 0.384

Alt 2.2 = $\frac{3.5-3.4}{4-3.4}$= 0.166

Alt 2.3 = $\frac{3.8-3.1}{3.8-3.1}$= 1

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Alt 2.4 = $\frac{3.4-3.4}{4.2-3.4}$= 0

Alt 2.5 = $\frac{3.3-3.2}{3.5-3.2}$= 0.333

Lecturer = Cipto, M.TI = (Alt 3)

Alt 3.1 = $\frac{4-2.7}{4-2.7}$= 1

Alt 3.2 = $\frac{3.9-3.4}{4-3.4}$= 0.833

Alt 3.3 = $\frac{3.8-3.1}{3.8-3.1}$= 1

Alt 3.4 = $\frac{4.4-3.4}{4.2-3.4}$= 1.25

Alt 3.5 = $\frac{3.5-3.2}{3.5-3.2}$= 1

Lecturer = Eko, M.TI = (Alt 4)

Alt 4.1 = $\frac{3.9-2.7}{4-2.7}$= 0.923

Alt 4.2 = $\frac{4-3.4}{4-3.4}$= 1

Alt 4.3 = $\frac{3.5-3.1}{3.8-3.1}$= 0.571

Alt 4.4 = $\frac{3.9-3.4}{4.2-3.4}$= 0.625

Alt 4.5 = $\frac{3.5-3.2}{3.5-3.2}$= 1

Lecturer = Rina, M.TI = (Alt 5)

Alt 5.1 = $\frac{3.7-2.7}{4-2.7}$= 0.769

Alt 5.2 = $\frac{3.7-3.4}{4-3.4}$= 0.5

Alt 5.3 = $\frac{3.5-3.1}{3.8-3.1}$= 0.571

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Alt 5.4 = $\frac{4.2-3.4}{4.2-3.4}$= 1

Alt 5.5 = $\frac{3.2-3.2}{3.5-3.2}$= 0

Table. Weighted matrix calculation results

Lecturer Name	kri 1	kri 2	kri 3	4	Kri 5
Adi	0	0	0	1	0.666
Eli	0.384	0.166	1	0	0.333
Cipto	1	0.833	1	1.25	1
EKO	0.923	1	0.571	0.625	1
Rina	0.769	0.5	0.571	1	0

Alt 1 = (2 * 0) + (3 * 0) + (2*0) + (2*1) + (1* 0.666)
= 0 + 0 + 0 + 2 + 0.666
= 2.666

Alt 2 = (2* 0.384)+(3* 0.166)+(2*1)+(2*0)+(1* 0.333)
= 0.768 + 0.498 + 0 + 2 + 0.333
= 3.599

Alt 3 = (2*1)+(3*0.833)+(2*1)+(2*1.25)+(1*1)
= 2 + 2499 + 2 + 2.5 + 1
= 9.999

Alt 4 = (2*0.923)+(3*1)+(2*0.571)+(2*0.625)+(1*1)
= 1.846 + 3 + 1.142 + 1.25 + 1
= 8.238

Alt 5 = (2*0769)+(3*0.5)+(2*0.571)+(2*1)+(1* 0)
= 1.538 + 1.5 + 1.142 + 2 + 0
= 6.18

Table. Matrix Normalization Results

No	Alt	Results	Rank
1	Adi	2,666	5
2	Eli	3,599	4
3	Cipto	9.999	1
4	Eko	8,238	2
5	Rina	6.18	3

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4.2 Calculation with the WASPAS Method

Table. Alternative data from each criterion

Alternative	Criteria				
	C1	C2	C3	C4	C5
A1	4	2	1	5	2
A2	3	3	2	5	3
A3	2	4	2	5	4
A4	2	4	4	3	4
A5	2	5	5	3	5

$$X\begin{bmatrix} 4 & 2 & 1 & 5 & 2 \\ 3 & 3 & 2 & 5 & 3 \\ 2 & 4 & 2 & 5 & 4 \\ 2 & 4 & 4 & 3 & 4 \\ 2 & 5 & 5 & 3 & 5 \end{bmatrix}$$

Matrix normalization is by calculating the normalized performance rating value of the alternative on the attribute based on the equation that is adjusted to the type of attribute as follows:

Normalization

$$R11 = \frac{4}{\max\{4\ 3\ 2\ 2\ 2\}} = \frac{4}{4} = 1$$

$$R21 = \frac{3}{\max\{4\ 3\ 2\ 2\ 2\}} = \frac{3}{4} = 0.75$$

$$R31 = \frac{2}{\max\{4\ 3\ 2\ 2\ 2\}} = \frac{2}{4} = 0.5$$

$$R41 = \frac{2}{\max\{4\ 3\ 2\ 2\ 2\}} = \frac{2}{4} = 0.5$$

$$R51 = \frac{2}{\max\{4\ 3\ 2\ 2\ 2\}} = \frac{2}{4} = 0.5$$

Normalization

$$R12 = \frac{2}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{2}{5} = 0.4$$

$$R22 = \frac{3}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{3}{5} = 0.6$$

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R32 = $\frac{4}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{4}{5} = 0.8$

R42 = $\frac{4}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{4}{5} = 0.8$

R52 = $\frac{5}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{5}{5} = 1$

Normalization

R13 = $\frac{1}{\max\{1\ 2\ 2\ 4\ 5\}} = \frac{1}{5} = 0.2$

R23 = $\frac{2}{\max\{1\ 2\ 2\ 4\ 5\}} = \frac{2}{5} = 0.4$

R33 = $\frac{2}{\max\{1\ 2\ 2\ 4\ 5\}} = \frac{2}{5} = 0.4$

R43 = $\frac{4}{\max\{1\ 2\ 2\ 4\ 5\}} = \frac{4}{5} = 0.8$

R53 = $\frac{5}{\max\{1\ 2\ 2\ 4\ 5\}} = \frac{5}{5} = 1$

Normalization

R14 = $\frac{5}{\max\{5\ 5\ 5\ 3\ 3\}} = \frac{5}{5} = 1$

R24 = $\frac{5}{\max\{5\ 5\ 5\ 3\ 3\}} = \frac{5}{5} = 1$

R34 = $\frac{5}{\max\{5\ 5\ 5\ 3\ 3\}} = \frac{5}{5} = 1$

R44 = $\frac{3}{\max\{5\ 5\ 5\ 3\ 3\}} = \frac{3}{5} = 0.6$

R54 = $\frac{3}{\max\{5\ 5\ 5\ 3\ 3\}} = \frac{3}{5} = 0.6$

Normalization

R15 = $\frac{2}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{2}{5} = 0.8$

R25 = $\frac{3}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{3}{5} = 0.6$

R35 = $\frac{4}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{4}{5} = 0.8$

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$R45 = \frac{4}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{4}{5} = 0.8$

$R55 = \frac{5}{\max\{2\ 3\ 4\ 4\ 5\}} = \frac{5}{5} = 1$

$$R\begin{pmatrix} 1 & 0.4 & 0.2 & 1 & 0.8 \\ 0.75 & 0.6 & 0.4 & 1 & 0.6 \\ 0.5 & 0.8 & 0.4 & 1 & 0.8 \\ 0.5 & 0.8 & 0.8 & 0.6 & 0.8 \\ 0.5 & 1 & 0.1 & 0.6 & 1 \end{pmatrix}$$

Q1= 0.5Σ(1x2)+(0.4x3)+(0.2x2)+(1x2)+(0.8x1)

=0.5Σ(2) + (1.2) + (0.4) + (2) + (0.8)

=0.5Σ(6.4)

=0.5x6.4

=3.2

Q1= $0.5\Pi(1)^{2} \times (0.4)^{3} \times (0.2)^{2} \times (1)^{2} \times (0.8)^{1}$

=0.5Π(1) x (0.064) x (0.04) x (1) x (0.8)

=0.5Π(0.0020)

=0.5x0.0020

=0.001

Q1 = 3.2 + 0.001 = 3.201

Q2= 0.5Σ(0.75x2)+(0.6x3)+(0.4x2)+(1x2)+(0.6x1)

=0.5Σ(1.5) + (1.8) + (0.8) + (2) + (0.6)

=0.5Σ(6.7)

=0.5x6.7

=3.35

Q2= $0.5\Pi(0.75)^{2} \times (0.6)^{3} \times (0.4)^{2} \times (1)^{2} \times (0.6)^{1}$

=0.5Π(0.562) x (0.216) x (0.16) x (1) x (0.6)

=0.5Π(0.011)

=0.5x0. 011

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=0.0055

Q2 = 3.35 + 0.0055 = 3.3555

Q3= 0.5Σ(0.5x2)+(0.8x3)+(0.4x2)+(1x2)+(0.8x1)

=0.5Σ(1) + (2.4) + (0.8) + (2) + (0.8)

=0.5Σ(7)

=0.5x7

=3.5

Q3= $0.5\Pi(0.5)^{2} \times (0.8)^{3} \times (0.4)^{2} \times (1)^{2} \times (0.8)^{1}$

=0.5Π(0.25) x (0.512) x (0.16) x (1) x (0.8)

=0.5Π(0.016)

=0.5x0.016

=0.008

Q3 = 3.5 + 0.008 = 3.508

Q4= 0.5Σ(0.5x2)+(0.8x3)+(0.8x2)+(0.6x2)+(0.8x1)

=0.5Σ(1) + (2.4) + (1.6) + (1.2) + (0.8)

=0.5Σ(7)

=0.5x7

=3.5

Q4= $0.5\Pi(0.5)^{2} \times (0.8)^{3} \times (0.8)^{2} \times (0.6)^{2} \times (0.8)^{1}$

=0.5Π(0.25) x (0.512) x (0.64) x (0.36) x (0.8)

=0.5Π(0.023)

=0.5x0.023

=0.011

Q4 = 3.5 + 0.011 = 3.511

Q5= 0.5Σ(0.5x2)+(1x3)+(0.1x2)+(0.6x2)+(1x1)

=0.5Σ(1) + (3) + (0.2) + (1.2) + (1)

=0.5Σ(6.4)

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=0.5x6.4

=3.2

Q5= $0.5\Pi(0.5)^{2}$ x $(1)^{3}$ x $(0.1)^{2}$ x $(0.6)^{2}$ x $(1)^{1}$

=0.5Π(0.25) x (1) x (0.01) x (0.36) x (1)

=0.5Π(0.0009)

=0.5x0.0009

=0.0004

Q5 = 3.5 + 0.0004 = 3.5004

From the results of the above calculations, it can be concluded that the performance of lecturers with these criteria by calculating the WASPAS method is as follows:

Table. Calculation Results of the Alert Method

No	Alt	Results	Rank
1	Adi	3.201	5
2	Eli	3.3555	4
3	Cipto	3,508	2
4	Eko	3.511	1
5	Rina	3.5004	3

5. CONCLUSION

From the calculations of the two methods carried out by researchers, it can be concluded that calculations using the MAUT method get the following values:

No	Alt	MAUT result	Rank
1	Adi	2,666	5
2	Eli	3,599	4
3	Cipto	9.999	1
4	Eko	8,238	2
5	Rina	6.18	3
Flat		6.1364	

Calculations using the WASPAS method get the following values:

No	Alt	Alert results	Rank
1	Adi	3.201	5
2	Eli	3.3555	4
3	Cipto	3,508	2
4	Eko	3.511	1

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5	Rina	3.5004	3
Flat		3.4151	

Based on the average calculation of the two average methods. The average of the MAUT method got a value of 6.1364, while the average of the WASPAS method got a value of 3.4151. The conclusion of this research, the method of MAUT is the right method to be used as a method in assessing the performance of lecturers at IBN.

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