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TOPSIS AND ELECTRE COMPARISON ANALYSIS ON WEB-BASED SOFTWARE

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Abstract

Methods in the Decision Support System (DSS) have their own techniques in solving organizational problems. Determining the appropriate DSS method with the problem is a common difficulty experienced by organizations. The performance of a DSS method can be measured in various ways. This research aims to determine the performance of the two DSS methods, specifically Technique for Others Preference by Similarity to Ideal Solution (TOPSIS) and Election at Choix Traduisant La Realite (ELECTRE) which are applied to the best lecturer selection system. The research was carried out on software designed using efficiency as one of the International Organization for Standardization (ISO) 9126. The performance of both methods tested on validity and sensitivity testing. The results showed that the TOPSIS performance was better in terms of efficiency and sensitivity. TOPSIS execution time is 0.0085 seconds faster and has a greater sensitivity value of 2.18% compared to ELECTRE. Validity result gave the best results reaching 100% to ELECTRE. That means, the ELECTRE calculation can be trusted because it has a perfect level of accuracy.

Key words: decision support system methods, TOPSIS, ELECTRE, efficiency, validity, sensitivity.

INTRODUCTION

Decision support systems is able to provide information for making decisions from specific semi-structured problem [1]. Constraints in decision making generally lie in the problem at hand [2] and the appropriate method to solve it.

In this research, the performance of the DSS method tested to TOPSIS and ELECTRE because those have a fairly long completion in implementation so it is necessary to know the level of sensitivity and validity of both in determining the best lecturer problem. This is the research objective to be achieved, followed by testing the efficiency of the software used in executing the two methods. Efficiency is one of the characteristics of ISO 9126 testing of software to determine the speed of the system in solving problems and the system's ability in using data [3].

The research on TOPSIS and ELECTRE has been widely conducted but little has been discussed about the sensitivity and validity of both. A number of studies used TOPSIS as decision support with various objects such as selecting property development location, cars, spillways and planning marketing strategies [4- 7]. TOPSIS can also be implemented to mobile application [8]. Others [9-11], used ELECTRE to evaluate the industrial requirements priority, performance of web-based lecturers, determine company demand with a priority scale of selecting raw materials for badminton racket making. While research [12] is to compare the performance of the two methods using financial ratios. While research on TOPSIS sensitivity is found in studies [13-14] which change the weight of one attributes to determine the level of TOPSIS sensitivity. In [15-16] showed the level of validity generated by ELECTRE.

The comparison of the two methods is done with web-based software which is built and tested for its efficiency. The contribution of this research lies in the speed with which the software measures the efficiency and validity of the two methods. Through the comparison of the performance of TOPSIS and ELECTRE, it is hoped that provide understanding and input to users in determining the appropriate DSS method to solve various organizational problems.

MATERIAL AND METHODS

Achievement of this research is supported by materials, data and methods.

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

TOPSIS is a decision making method multi- criteria with the basic idea that the best chosen alternative not only has the shortest distance from the positive ideal solution, but also has the longest distance from the negative ideal solution. [4]. The TOPSIS method consists of the following steps.

1. Normalized decision matrix, normalized value (r_{ij}) is calculated using the following equation:

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

Where
x_{ij}= Alternative i and criterion j
m = Alternative
r = Normalized

2. Matrix Weighted normalized decision matrix, weighted normalized value (y_{ij}) is calculated using the following equation:

$$y_{ij} = w_i r_{ij} \quad (2)$$

Where
y_{ij}= alternative weighted normalized matrix i and criterion j
w_i= weight alternative i
r_{ij}=, alternative normalized matrix i and criterion j

3. Positive ideal solution matrix and negative ideal solution matrix , the value of the positive ideal solution (A +) and the negative ideal matrix (A-) is calculated using the following equation:

$$A^+ = (y_1^+, y_2^+, \dots, y_n^+) \quad (3)$$
$$A^- = (y_1^-, y_2^-, \dots, y_n^-) \quad (4)$$

Where:

$$y_j^+ = \begin{cases} \max_i y_{ij}; \text{ if j is an attribute of profit} \\ \min_i y_{ij}; \text{ if j is an attribute of cost} \end{cases}$$

$$y_j^- = \begin{cases} \min_i y_{ij}; \text{ if j is an attribute of profit} \\ \max_i y_{ij}; \text{ if j is an attribute of cost} \end{cases}$$

4. The distance between the ideal solution positive (D_i^+) and the ideal matrix negative (D_i^-) is calculated using equation the following:

$$D_i^+ = \sqrt{\sum_{j=1}^{n}(y_i^+ - y_{ij})^2} \quad (5)$$

$$D_i^- = \sqrt{\sum_{j=1}^{n}(y_{ij} - y_i^-)^2} \quad (6)$$

5. Preference (V_i)) is calculated using the following equation:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (7)$$

Where:
V_i =preference value of the alternative i

Election at Choix Traduisant La Realite (ELECTRE)

ELECTRE is one of the methods used to rank and determine the best alternative with qualitative and quantitative features [17]. The ELECTRE method has the following stages.

1. Normalized decision matrix, normalized value (r_{ij}) is calculated using the following equation:

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}^2} \quad (8)$$

Where
x_{ij}= Alternative i and criterion j
m = Alternative
r = Normalized matrix

2. Matrix weighted normalized decision matrix, weighted normalized value (y_{ij}) is calculated using the following equation:

$$y_{ij} = w_i r_{ij} \quad (9)$$

Where
y_{ij}= weighted normalized matrix alternative i and the criterion j
w_i= weight of alternative i
r_{ij}= normalized matrix of alternative i and the criterion j.

3. Then determine concordances and discordances index for each pair of alternatives k and l (k, l = 1, 2, 3,..., m and k ≠ 1). When a criterion in an alternative includes concordance is determined by the following equation:

$$C_{kl} = \{J | y_{kj} \leq y_{lj}\}, \text{for } j = 1,2,3,\dots,n \quad (10)$$

4. The concordance and discordance matrix calculation.

a) Concordance, using the following equation:

$$C_{kl} = \sum_{j \in c_{kl}} W_J \quad (11)$$

b) Discordance, getting from formula below:

$$d_{kl} = \frac{\max\{|v_{kj} - v_{ij}|\}_{j \in d_{kl}}}{\max\{|v_{kj} - v_{ij}|\}\forall_j} \quad (12)$$

5. Calculate the dominant concordance and discordance matrix.

a) The dominant concordance is calculated by the following equation:

$$C = \frac{\sum_{k=1}^{n}\sum_{l=1}^{n} c_{kl}}{m(m-1)} \quad (13)$$

Value of each f matrix element as the dominant concordance matrix is determined by the following equation:

fkl=1, if ckl ≥ c and fkl=0, if ckl<c (14)

b) Dominant discordance, calculate with the following equation:

$$D = \frac{\sum_{k=1}^{n}\sum_{l=1}^{n} d_{kl}}{m(m-1)} \quad (15)$$

Determining the value of gkl matrix in the dominant discocodon matrix by the following equation:

gkl=1, if dkl ≥ d and gkl=0,

if dkl<d (16)

6. Determines the dominant aggregate matrix, the dominant aggregate value for the matrix (e) calculated using the following equation:

$$e_{kl} = f_{kl} \times g_{kl} \quad (17)$$

From this equation, the matrix e gives the order of choice for each alternative, if ekl = 1 then alternative Ak is a better choice than Ar so that the row in the matrix e which has the least number of ecl = 1 can be eliminated.

Efficiency Test

Software quality can be assessed through certain measures and methods, as well as software testing. In research [18], the discussion of ISO 9126 concerns the quality model, internal metric, external metric and quality metric.

One of the factors of the quality model that will be tested in this research is the efficiency by putting script in Figure 1 on the first line of the file php.

```
$time = microtime();
$time = explode(' ', $time);
$time = $time[1] + $time[0];
$start = $time;
```

Fig 1. First line script on php

Then it ends by putting script in Figure 2 at the end of the file to show the limit of how many lines of code that will be counted.

```
$time = microtime();
$time = explode(' ', $time);
$time = $time[1] + $time[0];
$finish = $time;
$total_time = round(($finish - $start), 4);
```

Fig 2. End line script on php

Sensitivity Test

Sensitivity test is to determine method sensitivity which is seen from the number of changes in ranking [19].

The degree of sensitivity (Sj) for each attribute is obtained through the following steps:

1. Determine all attribute weights, wj = 1 (initial weight), where j = 1, 2, ..., number of attributes
2. Change attribute weights in the *range* 1 - 2, as well as by increasing the weight value by 1 while the weight of the other attributes is still worth 1.
3. Normalizing the weight of the attribute by forming the weight value so that $\sum w = 1$.
4. Normalization of the attribute weight by forming the weight value so that $\sum w = 1$.
5. Apply it to the method for the attribute weights that have been formed. the percentage change in ranking is obtained from the comparison of the number of changes under the same weighted conditions (weight = 1).

Data Validity Test

The correlation contained in the total item shows the validity of the item. Data analysis with corrected item total correlation is done by correlating each items score with the total score and correlating the overtimated correlation coefficient value. The validity testing of a questionnaire is done by the validity of the factors and the validity of the items [20].

Correlation calculation produces a correlation coefficient to measure the validity of an item and to determine the item's feasibility. The validity of an item was determined by its significant correlation with a total score at the 0.05 level with the formula as in the following equation:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}} \quad (18)$$

r_{xy} = correlation coefficient between variable x and variable y

$\sum xy$ = number of multiplication between variables x and y

$\sum x^2$ = sum of the squared value x

$\sum y^2$ = sum of the squared value of y

$(xy)^2$ = total value x then squared ()2y= Total y then squared

Then the results of r_{xy} are consulted with the critical product moment price (R table), if the results obtained R count> R table, then the instrument is valid. The following is the R table from the data validity test.

Table 1. R Table

Amount of Data	The Level of Significance
….	…
28	0,374
29	0,367
30	0,361
31	0,355

Stages of Research

The research data was taken from a questionnaire consisting of 19 criteria and given in Table 2.

The questionnaire has been tested for validity and spread to at least 30 respondents [21]. The questionnaire was used to determine the best lecturer based on performance. Questionnaire data were processed using SPSS with criteria weights between 1 to 5. Criteria with a validity value> 0.361 were declared valid.

The questionnaire was distributed to 75 different respondents to get the best lecturer assessment. The questionnaire data is processed using the TOPSIS and ELECTRE methods through the software that has been built. Then the method is tested for sensitivity and validity, including the speed of the

software in executing both methods. The result is the performance information of the two methods based on the three testing techniques.

Table 2. Questionnaire Criterion

No	Questionnaire Criterion
1	Time teaching discipline
2	Become a role model and motivator
3	Creating an attractive learning atmosphere
4	Scientific communication with students (answering questions, inviting discussion)
5	Lecturers dressed neatly at the time of teaching
6	Suitability of course and exam materials
7	Provide feedback
8	Curriculum planning/development
9	Mastering learning theory and teaching learning principles
10	Development student potency
11	Honest
12	Independent
13	Behavior in accordance with the values and norms prevailing in society
14	Lecturer activeness through the committee
15	Has Scopus ID
16	Has an H Index
17	Lecturer research is funded by a research grant
18	Lecturer activeness through community service activities
19	Lecturer service is funded by community service grant

RESULT AND DISCUSSION

Questionnaire Testing

After the questionnaire was filled in, data validity was tested to obtain the correlation coefficient for each criterion using equation (18). The comparison results show that the correlation coefficient for each criterion that has a value> 0.361 can be declared valid.

The Weight of the Lecturer Selection Criteria

The weight of the lecturer selection criteria is calculated from the data collected by the questionnaire by dividing the total value of the respondents for the criteria by the number of respondents, so that the weighted criteria for criteria 1 to 19 are obtained. The complete weights results are in Table 3.

Table 3. Criterion Weights

Criterion	Weights
1	4,27
2	4,17
...	…
19	3,33

Next, look for the average score of each lecturer by adding up all the scores per criterion divided by the number of respondents. Complete results are seen in Table 4.

Table 4. Average Criteria Each Lecturer

Lecturer	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19
AH	3.80	4.12	4.21	4.01	3.61	4.03	4.21	3.99	4.35	4.23	4.37	4.03	4.08	3.61	3.72	3.79	3.56	4.08	3.79
DO	4.01	4.04	4.33	4.24	3.95	4.61	4.05	4.07	4.16	3.88	4.29	4.08	3.87	3.67	3.79	3.84	3.84	4.00	3.84
JH	4.03	3.77	4.03	3.89	3.52	4.08	3.96	3.76	3.96	3.69	4.01	3.88	3.77	3.76	3.63	3.68	3.67	3.73	3.71
WJ	4.32	4.24	4.15	4.08	3.93	4.28	4.05	3.93	4.17	4.11	3.99	4.05	4.05	3.91	4.08	4.08	4.05	4.04	4.00
SY	4.33	4.24	4.12	4.09	3.96	4.08	4.25	4.41	4.12	4.05	4.13	4.24	4.19	4.01	4.09	4.17	4.11	4.13	3.73

Calculation of the TOPSIS Method

To find the calculation of the TOPSIS method, the data that has been previously searched is used in the Table 4.

TOPSIS Normalized Matrix

To find a normalized matrix, equation (1) is used. The results are obtained as in Table 5 below.

Table 5. TOPSIS Normalized Matrix

Name	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19
AH	0.41	0.45	0.45	0.44	0.42	0.43	0.46	0.44	0.47	0.47	0.47	0.44	0.46	0.43	0.43	0.43	0.41	0.46	0.44
DO	0.44	0.44	0.46	0.47	0.47	0.49	0.44	0.45	0.45	0.43	0.46	0.45	0.43	0.43	0.44	0.44	0.45	0.45	0.45
JH	0.44	0.41	0.43	0.43	0.41	0.43	0.43	0.42	0.43	0.41	0.43	0.43	0.42	0.44	0.42	0.42	0.43	0.42	0.43
WJ	0.47	0.46	0.45	0.45	0.46	0.45	0.44	0.44	0.45	0.46	0.43	0.45	0.45	0.46	0.47	0.47	0.47	0.45	0.47
SY	0.47	0.46	0.44	0.45	0.47	0.43	0.46	0.49	0.44	0.45	0.44	0.47	0.47	0.47	0.47	0.48	0.48	0.46	0.44

TOPSIS Weighted Normalized Matrix

To find a weighted normalized matrix, equation (2) is used with the criteria weights in Table 3 so that the results are obtained as in Table 6 follow.

Table 6. TOPSIS Weighted Normalized Matrix

Name	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19
AH	1.75	1.88	2.10	1.85	1.47	2.01	2.01	1.60	2.21	1.89	2.08	1.91	1.89	1.36	1.54	1.49	1.38	1.70	1.47
DO	1.88	1.83	2.15	1.97	1.65	2.29	1.92	1.63	2.12	1.73	2.04	1.95	1.76	1.36	1.57	1.53	1.52	1.67	1.50
JH	1.88	1.71	2.01	1.81	1.44	2.01	1.88	1.52	2.02	1.65	1.90	1.86	1.72	1.39	1.50	1.46	1.45	1.55	1.43
WJ	2.01	1.92	2.10	1.89	1.61	2.10	1.92	1.60	2.12	1.85	1.90	1.95	1.85	1.46	1.68	1.63	1.58	1.67	1.57
SY	2.01	1.92	2.05	1.89	1.65	2.01	2.01	1.78	2.07	1.81	1.95	2.04	1.93	1.49	1.68	1.67	1.62	1.70	1.47

Ideal Positive and Negative Solutions TOPSIS

The ideal positive and negative solutions value obtained by equations (3) and (4) so that the results are as shown in Table 7.

Table 7. TOPSIS Positive and Negative Ideal Solution

K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	
2.01	1.92	2.15	1.97	1.65	2.29	2.01	1.78	2.21	1.89	2.08	2.04	1.93	1.49	1.68	1.67	1.62	1.70	1.57	Max
1.75	1.71	2.01	1.81	1.44	2.01	1.88	1.52	2.02	1.65	1.90	1.86	1.72	1.36	1.50	1.46	1.38	1.55	1.43	Min

Distance of Ideal Positive and Negative Solutions TOPSIS

The ideal positive and negative solution distance obtained by equation (5) and (6). The results are as shown in Table 8.

Table 8. TOPSIS Positive and Negative Ideal Solution Distance

Name	D+	D-
AH	0.62	0.50
DO	0.44	0.55
JH	0.82	0.15
WJ	0.39	0.63
SY	0.34	0.73

TOPSIS Preference

To find preferences, equation (7) is used with the results as in Table 9.

Table 9. Preference

Name	Nilai
JH	0.85
AH	0.55
DO	0.44
WJ	0.38
SY	0.34

Table 9 shows that Johan is the best lecturer because he has a higher preference score of 0.85 than other lecturers.

Calculation of the ELECTRE Method

The calculation of the ELECTRE method used the data in Table 4.

Based on equations (8) and (9), the results of the normalized matrix and weighted normalized matrix of ELECTRE (steps 1 and 2) are the same as the values generated by TOPSIS in Tables 5 and 6. Then the calculation is carried out according to the ELECTRE stage with the following explanation.

Matriks Concordance Index and Concordance ELECTRE

The concordance index and concordance matrix used equation (10) and (11) in order to get the results as shown in Table 10.

Table 10. ELECTRE Concordance Matrix

	AH	DO	JH	WJ	SY
AH	0	32.67	64.87	33.63	33.90
DO	46.18	0	72.51	42.20	29.50
JH	15.48	7.44	0	4.43	4.67
WJ	50.35	50.58	75.68	0	37.61
SY	57.85	49.68	75.68	54.28	0

Discordance Index and Discordance ELECTRE Matrix

The discordance index and discordance matrix obtained by equations (10) and (12) and the results are as in Table 11.

Table 11. ELECTRE Discordance Matrix

	AH	DO	JH	WJ	SY
AH	0	1.00	0.54	1.00	1.00
DO	0.57	0	0.11	0.68	0.61
JH	1.00	1.00	0	1.00	1.00
WJ	0.69	1.00	0.00	0	0.90
SY	0.54	1.00	0.00	1.00	0

Matrix Dominant Concordance ELECTRE

The next calculation is finding dominant matrix concordance. That results obtained by using equation (13) is to find the threshold of 41.96 and then equation (14) used to find the dominant concordance matrix as in Table 12.

Table 12. ELECTRE Concordance Dominant Matrix

	AH	DO	JH	WJ	SY
AH	0	0	1	0	0
DO	1	0	1	1	0
JH	0	0	0	0	0
WJ	1	1	1	0	0
SY	1	1	1	1	0

ELECTRE Dominant Discordance Matrix

ELECTRE dominant concordance matrix obtained from threshold of 0.73 that calculated by using equation (15). The equation (16) is used to find the dominant discordance matrix as in Table 13.

Table 13. ELECTRE Discordance Dominant Matrix

	AH	DO	JH	WJ	SY
AH	0	1	1	1	1
DO	0	0	0	0	0
JH	1	1	0	1	1
WJ	0	1	0	0	1
SY	0	1	0	1	0

Dominant Aggregate Matrix ELECTRE

To find the dominant aggregate matrix, equation (17) is used with the results as shown in Table 14.

Table 14. ELECTRE Dominant Aggregate Matrix

	AH	DO	JH	WJ	SY
AH	0	0	0	0	0
DO	0	0	0	0	0
JH	0	0	0	0	0
WJ	0	1	0	0	0
SY	0	1	0	1	0

Alternative ELECTRE Matrix

The ranking for the ELECTRE method obtained by adding a weighted normalized matrix of all the criteria of each lecturer in Table 6. The following results are in Table 15.

Table 15 shows that Suroyo is the best lecturers because he has a higher total score of 34.75 than other lecturers.

Table 15. ELECTRE Alternative Matrix

Ranking	Name	Total
1	SY	34,75
2	WJ	34,41
3	DO	34,07
4	AH	33,59
5	JH	32,19

Application of Efficiency Test

The application of efficiency tests to the TOPSIS and ELECTRE methods used the *scr*ipt in Figure 1 and 2. The results of the efficiency test are in Figures 3 and 4 below.

Fig 3. TOPSIS efficiency test

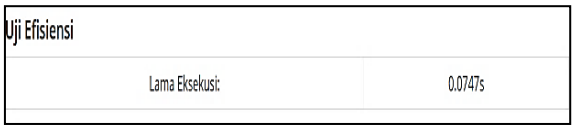

Fig 4. ELECTRE efficiency test

Figures 3 and 4 show that the efficiency test for the TOPSIS method is 0.0662s (seconds) and the ELECTRE method is 0.0747s (seconds).

Application of the Validity Test

The application of the validity test uses data from Table 4. The total value of each lecturer obtained by adding up the points from criteria 1 to 19 then dividing the number of criteria for each lecturer with the results as in Table 16.

Table 16. Best Lecturer Rank

Ranking	Name	Total
1	SY	4,13
2	WJ	4,08
3	DO	4,03
4	AH	3,98
5	JH	3,82

Furthermore, the total in Table 16 is compared with the ranking results for selecting the TOPSIS and ELECTRE methods as in Table 17.

Table 17. TOPSIS and ELECTRE Best Lecturer Rank

Ranking	TOPSIS		ELECTRE	
	Name	Total	Name	Total
1	JH	0,85	SY	34,75
2	AH	0,55	WJ	34,41
3	DO	0,44	DO	34,07
4	WJ	0,38	AH	33,59
5	SY	0,34	JH	32,19

Furthermore, the data ranking is compared in Table 16 and 17. The amount of data with the same position is divided by the total ranking multiplied by 100%. This method is to get the validity test results.

Table 18. Validity Test

Comparison	TOPSIS	ELECTRE
Validity Test	20%	100%

Table 18 shows that the validity test for the TOPSIS method is 20% and the ELECTRE method is 100%.

Application of the Sensitivity Test

The application of the sensitivity test uses the steps previously described. In the application of this sensitivity test, the weight of criterion 1 in Table 3 is added by 1 point so that the weight of the criteria is obtained as in Table 19 below.

Table 19. The Weight of Sensitivity Test Criteria

Criterion	Weights
1	5,27
2	4,17
…	…
19	3,33

Table 20. TOPSIS Rank Sensitivity Test

No	Name	Non Criteria	Criteria 1 (+1)
		Preference	Preference
1	AH	0.55	0,57
2	DO	0.44	0,42
3	JH	0.85	0,82
4	WJ	0.38	0,38
5	SY	0.34	0,34
Max		0,85	0,82

The calculation is continued as it has done previously to obtain the results of ranking the sensitivity testing for methods TOPSIS and ELECTRE on Table 20 and 21.

Table 21. ELECTRE Rank Sensitivity Test

No	Name	Non Criteria	Criteria 1 (+1)
		Value	Value
1	AH	33,59	34
2	DO	34,07	34,51
3	JH	32,19	32,63
4	WJ	34,41	34,88
5	SY	34,75	35,22
Max		34,75	35,22

Based on Tables 20 and 21, the sensitivity test results obtained by calculating the maximum value difference between the criteria before and after adding 1 in the TOPSIS and ELECTRE methods then the result of the difference distance is divided by the maximum value of the criteria before adding 1 and multiplied by 100%. Then the sensitivity test results are obtained in Table 22.

Table 22. TOPSIS and ELECTRE Sensitivity Test

Comparison	TOPSIS	ELECTRE
Normal Criteria	0,85	34,75
Criteria1 (+1)	0,82	35,22
Change	3,53%	1,35%

CONCLUSION

The results testing of TOPSIS and ELECTRE methods provide summary information as follow:

Table 23. TOPSIS and ELECTRE Result

Testing	TOPSIS	ELECTRE
Efficiency Test ISO 9126	0,0662s (second)	0,0747s (second)
Validity Test	20%	100%
Sensitivity Test	3,53%	1,35%

Table 23 shows that the software works more efficiently on the TOPSIS with 0,0662 second and faster 0,00085 second than ELECTRE. TOPSIS shows a fairly high level in 3,53% of sensitivity compared to ELECTRE with a difference of 2.18% of sensitivity testing. However, in the validity test, the ELECTRE calculation has a value of 100%. This means that ELECTRE is very accurate in producing calculations.

The difference with previous comparative studies [12] is that there is a testing technique where that research used financial performance, while this study uses sensitivity and validity. This study also tested the execution speed of both methods in data processing. The results of this research are expected to provide information about the performance of the two methods in assisting decision-making for various problems in accordance with the method itself. Research can be developed using all the characteristics of ISO 9126 to testing software that applies DSS method.

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