A HYBRID METHODS DSS FOR THE BEST PERFORMING LECTURERS SELECTION

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ABSTRACT

The hybrid method is a combination of the Analytical Hierarchy Process (AHP) method, the Profile Matching method, and the Composite Performance Index (CPI) method, which is used as a process in a decision support system (DSS) to select the best performing lecturers. The selection process requires a systematic mechanism to ensure consistency and transparency in making decisions. So this study used a hybrid method with the criteria listed in the teaching and learning scorecard and the results of student evaluations for selecting the best-performing lecturers. This research aims to provide knowledge about the computed value of the priority level and consistency ratio of criteria from the AHP method, as well as the competence GAP value from profile matching and the ranking value for each alternative using the CPI method. Results showed that the hybrid method succeeded in calculating the weight value of the level of importance and the criteria consistency ratio of 0.049 and was able to determine the best-performing lecturer from 46 alternatives as a candidate with the highest ranking score of 141.12.

KEYWORDS

Hybrid, Decision support system, Analytical hierarchy process, Profile matching, Composite performance index

1. INTRODUCTION

To improve the quality of tertiary education, various nursing staff are needed, one of which is human resources such as lecturers who can carry out their duties as educators, teachers, and community service in a professional manner [1]. For lecturers to carry out their duties, especially as educators and teachers, in a professional manner, a mechanism is needed to control their work assignments so that they remain focused on the targets set by the tertiary institution [2]. To control a task that is being carried out or has been carried out, an instrument is required, as listed in the teaching and learning scorecard and result of student evaluation, to know the percentage of lecturer performance in carrying out their duties as educators and teachers. So that it becomes a benchmark for higher education institutions to take steps when they encounter lecturer performance that is below the institution's target and to give appreciation to the best-performing lecturers to motivate others to remain diligent in carrying out their duties properly.

For earners, the best-performing lecturers require a systematic process so that decisions are consistent and transparent and based on established criteria. So we propose a hybrid method as a combination of the AHP method, the profile matching method, and the CPI method to support the determination of the best-performing lecturer based on criteria on the teaching and learning scorecard and the result of student evaluation, such as syllabus, teaching materials, teaching in

class, discipline, on-campus presence, outclass student assistance, teaching learning process, student knowledge, student evaluation, and teaching learning tools.

Where to calculate the important level weight, the consistency of each criterion value, and the weight value priority of each criterion utilized the AHP method. Meanwhile, to calculate the difference value gap between the data value and the target data and the competency gap value, we use the profile matching method. Furthermore, to calculate the mapping weight values in the form of decimals, we use linear interpolation. Meanwhile, to calculate the ranking value of each alternative, we use the CPI method.

Research on DSS begins with the definition of a decision support system [3], then develops into various methods such as the CPI used [4] for student admissions, [5] to determine the placement of village heads, [6] to determine scholarship acceptance, and [7] to determine the best bank members. Several studies are using other methods or combinations to support decision-making, such as [8] using the AHP and SMART methods, [9] using the AHP and Simple Adaptive Weighting (SAW), [10] using ELECTRE, [11] using the collaborative filtering method, and [12] using the SAW method to select and recommend the best lecturers. And also [13] combines the profile matching and TOPSIS methods to evaluate lecturer performance. In addition, [14] and [15] use the SAW method, while [16] combines the SAW method and MOORA method, [17] uses TOPSIS, [18] utilizes the SMART method to assess teacher performance, and [19] uses the MOORA method to determine the best teacher's performance. Meanwhile, [20] used file matching to select training instructors. and [21] combined the AHP and profile matching methods to determine the list of the best deans; [22] also combined the AHP and profile matching methods to select students for the Olympics; [23] combined the AHP method and profile matching for employee selection and promotion; and [24] utilized the PROMETHEE method to monitor and evaluate the performance of flight instructors.

From the explanation of previous research, it was found that there were various methods used to assist in solving the problem, but determining the important level of each criterion weight on the CPI in previous research was not tested for the value of consistency, so in this study, we used the AHP approach to test consistency and determine the weight of the importance level of each criterion. Besides that, we also use the profile matching method to match data values with target data to obtain better results.

The structure of this research consists of: Part 1 describes the problem ideas related to several previous studies; Part 2 presents the state-of-the-art or research methods; Part 3 presents the results and analysis; and Part 4 presents conclusions and further research.

2. RESEARCH METHOD

2.1. Materials

This study uses secondary data that has been provided by four faculties in the form of the results of teaching evaluations for two semesters in the 2022 period, as well as criteria data and achievement target scores listed in the teaching and learning scorecard and student evaluation formats at the Dili Institute of Technology (DIT), as shown in Table 1. The data criteria and target values will be used as the target values in this study

Table 1. Target Values

Criteria Names	Criteria Symbols	Criteria Values
Syllabus	S	4
Teaching Learning Materials	TLM	4
Teaching in Class	TC	4
Discipline	D	4
On Campus Presence	OCP	4
Outclass Student Assistance	OSA	4
Teaching Learning Process	TLP	5
Student Knowledge	SK	5
Student Evaluation	SE	5
Teaching Learning Tools	TLT	5

The process of determining the best-performing lecturer begins with checking the completeness of the teaching materials and filling in the weighted scores into the teaching and learning scorecard and the result of student evaluation by the internal assessor. The results of the assessment are submitted to the respective faculties. And the secretaries of each faculty will be submitted to IQA to determine the outstanding lecturer candidates.

2.2. Hybrid Methods

In this study, a state-of-the-art approach proposes a hybrid method, namely combining the AHP method, the profile matching method, and the CPI method through several stages to obtain a decision result (see Figure 1)

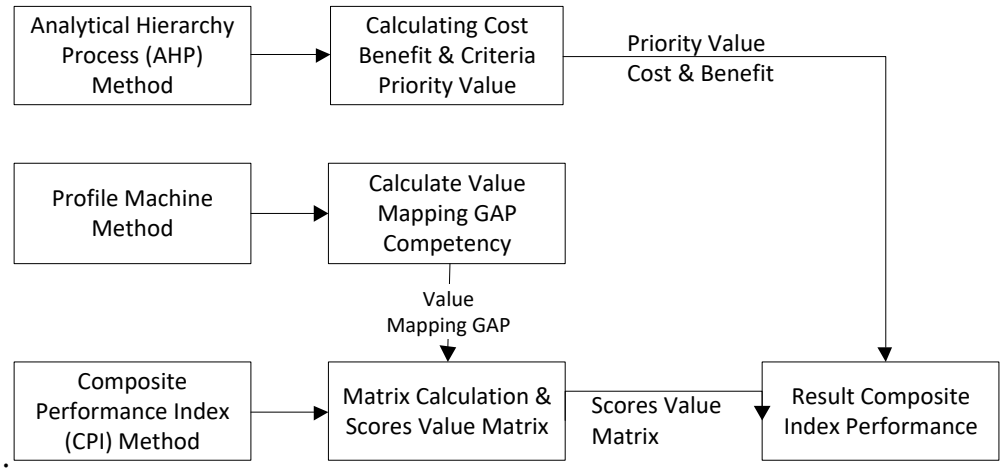

Figure 1. Hybrid Methods Propose

The AHP method is used to calculate the cost-benefit weight value and the priority criteria weight, which will later be used by the CPI, where the profile matching method is utilized to compute the value of GAP competency, and the CPI is used to compute the ranking using the value of GAP competency and the criteria priority weight value to obtain the final result.

2.2.1. AHP Method

Case settlement begins with the AHP method. The procedure for the AHP method goes through several stages, namely

a) Establishing a hierarchical process structure (shown in Figure 2) [25]

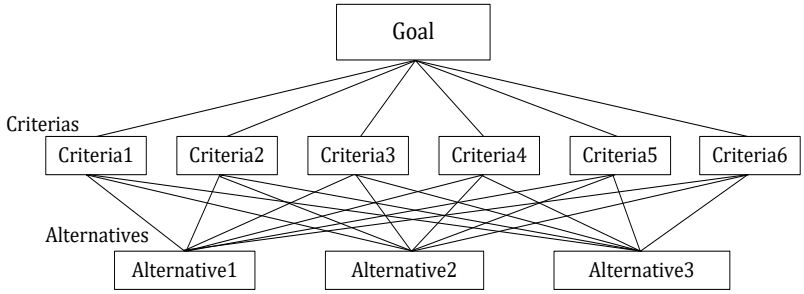

Figure 2. Structure of AHP

Starting with setting goals, and determining the criteria that will be required by each alternative to achieve the goals that have been set

b) Set value pairwise comparison scale for each criterion with Table 2 [26].

Table 2. Fundamental Absolute Numbers Scale

Important Strength	Meaning	Description
1	The importance is identical	Both aspects have the same contribution
3	Moderate significance of one over another	Assessment of one aspect slightly above one other aspect
5	Crucial of powerful significance	Assessment of the activity of one aspect strongly favors over the other
7	Very powerful significance	The activity of one aspect is preferred over another; he said in practice
9	Very grade significance	Evidence of the activity of one aspect supports it above the other as the highest stage of discernment
2, 4, 6, 8	The intermediate value between the two adjacent judgments	when a compromise is needed

c) Perform matrix comparison calculations for each parameter with equation (1) [27]

$$\begin{bmatrix} & A_1 & A_2 & \cdots & \cdots & A_n \\ A_1 & \frac{W_1}{W_1} & \frac{W_1}{W_2} & \cdots & \cdots & \frac{W_1}{W_n} \\ A_2 & \frac{W_2}{W_1} & \frac{W_2}{W_2} & \cdots & \cdots & \frac{W_2}{W_n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \cdot & \cdot & \cdot & \cdots & \cdots & \cdot \\ A_n & \frac{W_1}{W_1} & \frac{W_1}{W_1} & \cdots & \cdots & \frac{W_n}{W_n} \end{bmatrix} \begin{bmatrix} W_1 \\ W_2 \\ \cdot \\ \vdots \\ \cdot \\ W_n \end{bmatrix} = n \begin{bmatrix} W_1 \\ W_2 \\ \cdot \\ \vdots \\ \cdot \\ W_n \end{bmatrix} \quad (1)$$

Where :

A1 ... An = criteria/sub-criteria/program alternatives.
w1...wn = weight of criteria/sub-criteria/program alternatives

d) Calculating the consistency ratio value from the comparison of criteria results using equation (3) and equation (2) is utilized to compute the consistency index (CI)[25]

$$CI = \left(\frac{\lambda max - n}{n - 1}\right) \quad (2)$$

Where:

CI = Index of Consistency
λmax = Max of Eigenvalue
n = Matrix Order

$$CR = \frac{CI}{RI} \quad (3)$$

Where:

CR = Ratio of Consistency
CI = Index of Consistency
RI = Index of Random (see Table 3).

If the consistency ratio value is > 10% or 0,1 is declared inconsistent, then the determination of the value of the importance level between the criteria is corrected. But if the consistency ratio value is ≤0,1 declared that consistent, then it can proceed to the next process.

Table 3. Random Consistency Index (R.I.) [25]

N	1	2	3	4	5	6	7	8	9	10	…..	15
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49	…..	1.58

2.2.2. Profile Matching Method

Utilized to do:

a) Calculation of the competency gap value, using equation (4) [20]

$$Gap = Value\ Attribute - Value\ Targe \quad (4)$$

Where:

Attribute values = Real value owned by candidates
Target values = Requirement Value set

b) Replace the value of the difference in competency GAP for each criterion with the weighted values in Table 4 [28]

Table 4. GAP Score Weight

No	Difference (GAPS)	Value Weight	Information
1	0	6	Not GAP
2	1	5,5	Individual ability >1 grade/individual ability <1 grade/individual ability grade 2 grades
3	-1	5	Individual ability <2 grades/ grade Individual ability 3 grades/grade
4	2	4,5	Individual ability <3 grades/grade of individual ability >4 grades/grade
5	-2	4	Individual competence <4 grades/grade
6	3	3,5	individual ability is 5 grades/grades
7	-3	3	Individual ability <5 grades/grades
8	4	2,5	Not GAP
9	-4	2	Individual ability >1 grade/individual ability <1 grade/grade individual ability >2 grade/grade
10	5	1,5	Individual ability <2 grades /grade the individual ability is 3 grades/grade
11	-5	1	Individual ability <3 grades/grade of individual ability >4 grades/grade

Substitution of competency gap values with value weights in Table 4 is used only for integer competency GAP values. For competence GAP values in the form of decimal numbers, equations (5), (6), and (7) [28] can be used

GAP value weight (positive number) = 5 - (GAP mapping value x 1) + 0.5 (5)
GAP value weight (number 0) = 5 – (GAP mapping value x 1) (6)
GAP value weight (negative number) = 5 – (GAP mapping value x -1) (7)

2.2.3. CPI Method

Utilized to compute ranking of options (i) be based on various benchmark (j) [29] using equation (8) as follows.

$$A_{ij} = \frac{x_{ij}(min)}{x_{ij}(min)} x\ 100 \qquad (8)$$

$$A_{(i+1,j)} = \frac{x_{(i+1,j)}}{x_{ij}(min)} x\ 100$$

$$I_{ij} = A_{ij}\ x\ p_j$$

$$I_j = \sum_{j=1}^{n} I_{ij}$$

Where:

A_{ij} = options value of benchmark *ij*
$X_{ij\ (min)}$ = *i* options value at the lowest initial benchmark *j*
$A_{(i\ +\ 1,j)}$ = options value for *i + 1* on benchmark *j*
$X_{(I\ +\ 1,j)}$ = options value for *i + 1* at the start of criterion *j*
Acting= importance weight benchmark *j*

I_{ij}= options index *i*

I = composite index on options benchmark *i*
i = 1,2,3, …, *n*
j = 1,2,3, ..., *m*

CPI work procedures can be carried out through several stages [29]

a. Recognize criteria: positive trend (the result will be better if the score is higher)
b. The trend-positive of criteria, the value lowest of every criterion is modified into 100, while the other values are modified evenly top.
c. In trend-negative of criteria, the value lowest of every criterion is modified into 100, while the others are modified to lower values.
d. Computing alternative value by sum of multiplication the criterion value with criteria weighting

Alternatives ranking is compute based on Bayes model, with equation (9) as follows.

$$N_{ki} = \sum_{j=1}^{n} V_{ij} x B_j \qquad (9)$$

$$\sum_{j=1}^{n} B_i = 1.0$$

Where:

N_{ki} = Final result value of alternative *i*
N = Total of alternative
B_j = Importance level of benchmark *j*
V_{ij} = alternative value *i* on benchmark *j*
I, j = 1, 2, 3 ...*n*

3. RESULTS

The research results are applied based on the stages in the State of art approach which begins with the preparation of a hierarchical process structure (see Figure 3).

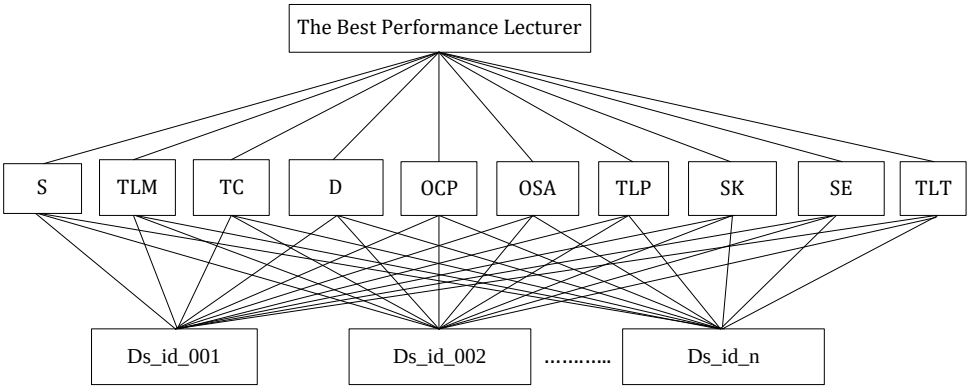

Figure 3. The Best Lecturer Hierarchy Processes

Alternative as lecturer candidates who will be selected based on the performance criteria set out in the teaching & learning score-card, to be selected as the best-performing lecturer in carrying out their duties.

3.1. Build a Matrix Comparison

Decide the important value level between criteria according to Table 2 and calculate the value of the comparison matrix with equation (1), result of the comparison matrix contained in Table 5.

Table 5. Comparison Matrix

Goal	S	TLM	TC	D	OCP	OSA	TLP	SK	SE	TLT
S	1	2	2	3	3	5	5	5	5	5
TLM	0,500	1	2	3	3	5	5	5	5	5
TC	0,500	0,500	1	2	3	3	3	5	5	3
D	0,333	0,333	0,500	1	2	3	3	3	3	5
OCP	0,333	0,333	0,333	0,50	1	2	3	3	3	5
OSA	0,200	0,200	0,333	0,33	0,50	1	2	3	3	5
TLP	0,200	0,200	0,333	0,33	0,33	0,500	1	2	2	2
SK	0,200	0,200	0,200	0,33	0,33	0,333	0,5	1	2	2
SE	0,200	0,200	0,200	0,33	0,33	0,333	0,5	0,5	1	2
TLT	0,200	0,200	0,333	0,20	0,20	0,200	0,5	0,5	0,5	1
TOTAL	**3,667**	**5,167**	**7,233**	**11,033**	**13,700**	**20,367**	**23,500**	**28,000**	**29,500**	**35,000**

3.2. Calculating the Priority Value of the Criteria

Using equation (1) to calculate the weight value of the comparison between the criteria. The total row value is obtained from the sum of the rows for each criterion, and so on. While the priority value of the criteria is obtained from the value of the total row for each criterion divided by the total number of criteria (n), the total value of the matrix comparison is obtained from the total sum of rows for every criterion of the normalized matrix divided by the total priority value of every criterion (see Table 6).

Table 6. Priority Value of the Criteria

Goal	S	TLM	TC	D	OCP	OSA	TLP	SK	SE	TLT	Total Rows	Priority Values
S	0,273	0,387	0,276	0,272	0,219	0,245	0,213	0,179	0,169	0,143	2,376	**0,24**
TLM	0,136	0,194	0,276	0,272	0,219	0,245	0,213	0,179	0,169	0,143	2,046	**0,20**
TC	0,136	0,097	0,138	0,181	0,219	0,147	0,128	0,179	0,169	0,086	1,480	**0,15**
D	0,091	0,065	0,069	0,091	0,146	0,147	0,128	0,107	0,102	0,143	1,088	**0,11**
OCP	0,091	0,065	0,046	0,045	0,073	0,098	0,128	0,107	0,102	0,143	0,897	**0,09**
OSA	0,055	0,039	0,046	0,030	0,036	0,049	0,085	0,107	0,102	0,143	0,692	**0,07**
TLP	0,055	0,039	0,046	0,030	0,024	0,025	0,043	0,071	0,068	0,057	0,457	**0,04**
SK	0,055	0,039	0,028	0,030	0,024	0,016	0,021	0,036	0,068	0,057	0,374	**0,04**
SE	0,055	0,039	0,028	0,030	0,024	0,016	0,021	0,018	0,034	0,057	0,322	**0,03**
TLT	0,055	0,039	0,046	0,018	0,015	0,010	0,021	0,018	0,017	0,029	0,267	**0,03**
Total	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**10,000**	**1,00**

Calculating the CR value using equation (3) and the C.I. value is obtained using equation (2) where n or the total criteria = 10 and the I.R. value is taken from Table 3. The calculation results are as follows:

$$CI = \left(\frac{10{,}658-10}{10-1}\right) = 0{,}073$$

$$CR = \frac{0{,}073}{1{,}49} = 0{,}049$$

The consistency ratio value is ≤0,1, so it is said to be consistent

3.3. Calculating the Competency GAP Value

The calculation of the competency GAP value in this case uses equation (4) and the profile matching method. Where the value attributes is real for each alternative value and the target value is set from table 1. As a result of calculating the competency gap, we present five (5) alternatives as an example of 46 alternatives. For example, if the value attribute is 4, and the value target is 4, the result of the gap is 0. Results of the competency gap values for each alternative are shown in Table 7.

$GAP = 4 - 4 = 0$ or 3,65 – 4 = 0,35

Table 7. Competency GAP Score

Lecturer_id	S	TLM	TC	D	OCP	OSA	TLP	SK	SE	TLT
Ds_id_001	4	4	4	3	4	4	4	4	4	4
Ds_id_002	3,65	3,5	3,68	3	3	3	4,3	4,2	4,1	4,1
Ds_id_003	2,59	2,5	2,72	3	2	3	4	3,8	3,7	4
Ds_id_004	4	4	4	3	2	3	4,3	4,1	4,1	3,8
Ds_id_005	3,32	1,9	3	3	3	3	4,2	4	4,2	4,1
Value Targets	**4**	**4**	**4**	**4**	**4**	**4**	**5**	**5**	**5**	**5**
Ds_id_001	0	0	0	1	0	0	1	1	1	1
Ds_id_002	0,35	0,5	0,32	1	1	1	0,7	0,8	0,9	0,9
Ds_id_003	1,41	1,5	1,28	1	2	1	1	1,2	1,3	1
Ds_id_004	0	0	0	1	2	1	0,7	0,9	0,9	1,2
Ds_id_005	0,68	2,1	1	1	1	1	0,8	1	0,8	0,9

3.4. GAP Competence Weighting

For Gap result values which are integers, the competency GAP value weighting is done by substituting the GAP result values with weight values in Table 3. For example, if the value of the GAP is 0 then competence weighting is 6. Furthermore, for the GAP result values of decimal type, like the value of the GAP number 0 = 0,35 then competence weighting needed to use equations (6), and value of the GAP positive number = 1,28 competence weighting needed to use equations (5). Such as

GAP value weight (number 0) = 5 – (0,35 x 1) = 4,65
GAP value weight (Positive number) = 5 – (1,41*1)+0,5
GAP value weight (Positive number) = 4,09

Outcome of the substitution of GAP weights for every alternative for each criterion are provided in Table 8.

Table 8. The Competency GAP Score

Lecturer_id	S	TLM	TC	D	OCP	OSA	TLP	SK	SE	TLT
Ds_id_001	6	6	6	5,5	6	6	5,5	5,5	5,5	5,5
Ds_id_002	4,65	4,5	4,68	5,5	5,5	5,5	4,3	4,2	4,1	4,1
Ds_id_003	4,09	4	4,22	5,5	4,5	5,5	5,5	4,3	4,2	5,5
Ds_id_004	6	6	6	5,5	4,5	5,5	4,3	4,1	4,1	4,4
Ds_id_005	4,32	3,4	5,5	5,5	5,5	5,5	4,2	5,5	4,2	4,1
Minimum	**4,09**	**3,4**	**4,22**	**5,5**	**4,5**	**5,5**	**4,2**	**4,1**	**4,1**	**4,1**

3.5. Calculation of Ranking Score Matrix

The CPI work process begins with determining positive criteria and negative trends (the results will be better if the value is higher). In this case, get six (6) positive trend criteria and four (4) negative trend criteria with their weight values, listed in Table 9

Table 9. Criteria Weight and Trends

No	Criteria	Weight	Trends
1	S	0,24	positive
2	TLM	0,20	positive
3	TC	0,15	positive
4	D	0,11	positive
5	OCP	0,09	positive
6	OSA	0,07	positive
7	TLP	0,04	negative
8	SK	0,04	negative
9	SE	0,03	negative
10	TLT	0,03	negative

It should be noted that the value of weight for every criterion in Table 8 is obtained from the priority value of the criteria calculated using the AHP method based on Table 6

Then calculate the value of ranking for each alternative with each criterion using equation (8). Meanwhile, the ranking value for each alternative can be calculated using equation (9).

N_{ki}=(146,70*0,24)+(176,4*0,20)+(142,18*0,15)+(100*0,11)+(133,33*0,09)+(109,09*0,07)+(1
30,95*0,04)+(134,15*0,04)+(134,15*0,03)+(134,15*0,03)
N_{ki} = 141,12

Thus the ranking value and ranking value for each alternative are displayed in Table 10.

Table 10. Rating Value and Ranking of Each Alternative

Lecturer_id	S	TLM	TC	D	OCP	OSA	TLP	SK	SE	TLT	Rank Results
Ds_id_001	146,70	176,47	142,18	100,00	133,33	109,09	130,95	134,15	134,15	134,15	**141,12**
Ds_id_002	113,69	132,35	110,90	100,00	122,22	100,00	102,38	102,44	100,00	100,00	**113,52**
Ds_id_003	100,00	117,65	100,00	100,00	100,00	100,00	130,95	104,88	102,44	134,15	**106,06**
Ds_id_004	146,70	176,47	142,18	100,00	100,00	100,00	102,38	100,00	100,00	107,35	**133,14**
Ds_id_005	105,62	100,00	130,33	100,00	122,22	100,00	100,00	134,15	102,44	100,00	**109,34**

The calculation results in Table 10 show that the alternative with *Ds_id_001* has the highest ranking value with a weight of 141,12. So it deserves to be the best-performance lecturer when compared to other alternatives.

4. CONCLUSIONS

The hybrid method is a combination of AHP, CPI, and profile matching methods utilized to determine the best lecturer performance at the Dili Institute of Technology (DIT). With a consistent criteria ratio value of 0,049, the consistent ratio value is 0,1, so it is said to be consistent so that the priority weight value for each criterion obtained by the AHP method can be used for further processing in the CPI method. The hybrid method succeeded in determining one alternative to be the best-performing lecturer from 46 candidates, with the highest ranking value of 141,12. In the future, this research needs to involve other criteria, such as community services, research, and work behaviour lecturers, to obtain better results.

ACKNOWLEDGEMENTS

At the end of this study, the author thanks Dr. Abdullah Z. Abidin for funding the publication, four faculties at the Dili Institute of Technology for providing the data, and all the lecturers involved in making this research happen.

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