

Composite performance index as decision support method for multi case problem

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Abstract

Assessment is an important part of vocational learning evaluations to be done carefully, thoroughly and profoundly to obtain objective assessment criteria. If the assessment of professional practice is not done objectively, it can provide students' bias and sense of injustice. This study provides an e-monitoring offer and compares e-monitoring with personal computers and Android mobile in process-based assessment. The study used ten vocational instructors with 31 subjects tested. Assessment criteria refer to the ten assessment standards are valid, objective, fair, integrated, open, systematic, relating to the requirements, accountable, and educative. The results showed that active e-monitoring was applied after post-condition on the first, second and third day

Keywords: E-Monitoring; Vocational Learning Practice; Process-Based Assessment.

1. Introduction

Decision making within an organization is very important and must be obtained quickly and accurately[1]–[4]. Implementation of information technology [5]–[8] is one way that can be used to help decision makers get a good recommendation before the decision is taken[9]–[13]. Decision Support System is a technique that can be used to assist decision makers based on data in the process with predetermined criteria so as to accelerate the assessment of the decision to be taken [14]–[17]

Decision-making can be done in an intuitive and analytical way. Intuitively taken decisions become appropriate when decision making is in the same situation and has done the previous analysis[18]. Decisions that are preceded by the analysis take longer due to the need for proper data and appropriate processing methods so that the proposed decisions can be applied properly. Decision-making methods such as Analytical Hierarchy Process (AHP)[19], Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)[20], Simple Additive Weighting (SAW), Simple Multi-Attribute Rating Technique (SMART)[10], PROMETHEE, Fuzzy[21]–[24], and Composite Performance Index[25] can be used to analyze data based on the situation and criteria used.

Composite Performance Index (CPI) is a composite index that can be used to determine the determination or ranking of various alternatives based on several criteria, the use of CPI methods for alternatives with dynamic criteria is very appropriate to be used to get good results so that decision-making has a small error margin[14] as well.

2. Methods

Decision Support Systems (DSS) began to be developed in the 1960s, but the term Decision Support System itself only emerged in 1971, coined by G. Anthony Gorry and Michael S. Scott Morton, both professors at MIT. They do so in order to create a framework for directing computer applications to management decision making[9], [10]. Meanwhile Pioneer another decision supporter of MIT is Peter G.W. Keen, in collaboration with Scott Morton, has defined three goals that the decision support system must achieve[11]:

- The system should be able to assist managers in making decisions to solve semi-structured problems.
- The system should be able to support the manager, not try to replace it.
- The system should be able to improve the effectiveness of manager decision making.

The Composite Performance Index is a composite Index that can be used to determine the determination or ranking of alternatives based on several criteria, formula Composite Performance Index[25] as follows:

$$A_{ij} = \frac{x_{ij}(\min)}{x_{ij}(\max)} \times 100 \quad (1)$$

$$A_{(i+1,j)} = \frac{x_{(i+1,j)}}{x_{ij}(\min)} \times 100 \quad (2)$$

$$I_{ij} = A_{ij} \times P_j \quad (3)$$

$$I_j = \sum_{j=1}^n I_{ij} \tag{4}$$

Information:

- A_{ij} = the i-th alternative value on the j-th criterion
- X_{ij} (min) = the i-th alternative value of the j minimum initial criterion
- A_(i+1,j) = i + 1st alternate value on the j-th criterion
- X_(i+1,j) = the i + 1st alternate value in the j-initial criterion
- P_j = weight of interest criteria to j
- I_{ij} = the i-th alternative index
- I = Composite index criteria on i-th alternate
- i = 1, 2, 3, n
- j = 1, 2, 3, m

The procedures in the Composite Performance Index are listed as follows:

- a) Identify the positive trend criteria.
- b) For positive trend criteria, the minimum value on each criterion is transformed to a hundred, while the other values are transformed proportionately higher.
- c) For negative trend criteria, the minimum value on each criterion is transformed to a hundred, while the other values are transformed lower.
- d) The calculation of the alternative value is the sum of the multiplication between the criterion value and the criterion weight.

The alternatives into rankings are calculate using Bayes model.

$$N_{ki} = \sum_{j=1}^n V_{ij} \times B_j \tag{5}$$

$$\sum_{j=1}^n B_j = 1.0 \tag{6}$$

Information:

- N_{ki} = Final value of i alternative
- V_{ij} = Value of i alternative on the j criterion
- B_j = the weight of the j th criterion
- I, j = 1, 2, 3, n; n = number of alternatives

3. Results and discussion

Tests using the Composite Performance Index (CPI) method required criteria and weights to perform the calculations so that the best alternative will be obtained.

- a) Criteria and Weight

The information needs of the proposed decision support system are:

- 1) Criteria required
- 2) Weights and Trends, weights and trends are shown in table 1

Weight is the percentage of the value of the criteria to be taken. The total weight of the criteria when added is no more than one.

Table.1: Weight and Trend Criteria

No	Criteria	Weight	Trend
1	Criteria_1	0.4	+
2	Criteria_2	0.1	-
3	Criteria_3	0.2	-
4	Criteria_4	0.3	+

- 3) Manual Calculation

Manual calculations done with the data as in table 2.

Table.2: Assessment Data

No	Alternative	C_1	C_2	C_3	C_4
1	C001	80	70	80	80
2	C002	80	80	70	70
3	C003	80	80	60	85
4	C004	80	70	60	70

5	C005	80	70	70	80
Min Value		80	70	60	70

- a) Value Calculation for C_1

The trend on criterion C_1 are + value, the higher are better.

Trend (+) = N_Value/Min_Value * 100

- 1) 80 : 80 = 1 * 100 = 100
- 2) 80 : 80 = 1 * 100 = 100
- 3) 80 : 80 = 1 * 100 = 100
- 4) 80 : 80 = 1 * 100 = 100
- 5) 80 : 80 = 1 * 100 = 100

Table.3: Calculating Value of C_1

No	Alternative	C_1	Min/N	N/Min*100
1	C001	80	1	100
2	C002	80	1	100
3	C003	80	1	100
4	C004	80	1	100
5	C005	80	1	100

- b) Value Calculation for C_2

The trend on criterion C_2 are - value, lower value much better than high value

Trend (-) = Min_Value/N_Value * 100

- 1) 70 : 70 = 1 * 100 = 100
- 2) 70 : 70 = 1 * 100 = 100
- 3) 70 : 80 = 0,87 * 100 = 87
- 4) 70 : 80 = 0,87 * 100 = 87
- 5) 70 : 70 = 1 * 100 = 100

Table.4: Calculating Value of C_2

No	Alternative	C_2	Min/N	N/Min*100
1	C001	70	1	100
2	C002	70	1	100
3	C003	80	0,87	87
4	C004	80	0,87	87
5	C005	70	1	100

- c) Value Calculation for C_3

The trend on criterion C_3 are - value, higher value better

Trend (-) = N_Value / Min_Value * 100

- 1) 60 : 80 = 0,75 * 100 = 75
- 2) 60 : 70 = 0,857 * 100 = 85,7
- 3) 60 : 60 = 1 * 100 = 100
- 4) 60 : 60 = 1 * 100 = 100
- 5) 60 : 70 = 0,857 * 100 = 85,7

Table.5: Calculating Value of C_3

No	Alternative	C_3	Min/N	N/Min*100
1	C001	80	0,75	75
2	C002	70	0,857	85,7
3	C003	60	1	100
4	C004	60	1	100
5	C005	70	0,857	85,7

- d) Value Calculation for C_4

The trend on criterion C_4 are + value, higher value better

Trend (+) = N_Value / Min_Value * 100

- 1) 80 : 70 = 1,14 * 100 = 114
- 2) 70 : 70 = 1 * 100 = 100
- 3) 85 : 70 = 1,21 * 100 = 121
- 4) 70 : 70 = 1 * 100 = 100
- 5) 80 : 70 = 1,14 * 100 = 114

Table.6: Calculating Value of C_4

No	Alternative	C_4	Min/N	N/Min*100
1	C001	80	1,14	114
2	C002	70	1	100
3	C003	85	1,21	121
4	C004	70	1	100
5	C005	80	1,14	114

e) Calculation of CPI

$$\text{CPI} = \text{value_C_1} * \text{Weight} + \text{value_C_2} * \text{Weight} + \text{value_C_3} * \text{Weight} + \text{value_C_4} * \text{Weight}$$

1) Calculation Alternative C001

$$\begin{aligned} \text{CPI} &= 100 * 0,4 + 100 * 0,1 + 75 * 0,2 + 114 * 0,3 \\ &= 40 + 10 + 15 + 34,2 \\ &= 99,2 \end{aligned}$$

2) Calculation Alternative C002

$$\begin{aligned} \text{CPI} &= 100 * 0,4 + 100 * 0,1 + 85,7 * 0,2 + 100 * 0,3 \\ &= 40 + 10 + 17,14 + 30 \\ &= 97,14 \end{aligned}$$

3) Calculation Alternative C003

$$\begin{aligned} \text{CPI} &= 100 * 0,4 + 87 * 0,1 + 100 * 0,2 + 121 * 0,3 \\ &= 40 + 8,7 + 20 + 36,3 \\ &= 105 \end{aligned}$$

4) Calculation Alternative C004

$$\begin{aligned} \text{CPI} &= 100 * 0,4 + 87 * 0,1 + 100 * 0,2 + 100 * 0,3 \\ &= 98,7 \end{aligned}$$

5) Calculation Alternative C005

$$\begin{aligned} \text{CPI} &= 100 * 0,4 + 100 * 0,1 + 85,7 * 0,2 + 114 * 0,3 \\ &= 40 + 10 + 17,14 + 34,2 \\ &= 101,34 \\ &40 + 8,7 + 20 + 30 \\ &= 98,7 \end{aligned}$$

6) Calculation Alternative C005

$$\begin{aligned} \text{CPI} &= 100 * 0,4 + 100 * 0,1 + 85,7 * 0,2 + 114 * 0,3 \\ &= 40 + 10 + 17,14 + 34,2 \\ &= 101,34 \end{aligned}$$

Table.7: Final Results

NO	Alternative	CPI Value
1	C001	105
2	C005	101,34
3	C003	98,7
4	C002	99,2
5	C004	97,14

4. Conclusion

The use of Composite Performance Index method to get decision result from many criteria and alternative can be done well, this method is easy enough to be implemented manually and system and can be combined with many methods.

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