Performance Evaluation Of Research Assistants By Copras Method

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Abstract

Performance evaluation of research assistant has become an important factor and a strategic decision for universities. However, this decision is generally complex. Many conflicting criteria should be taken into account at the same time. Correct solution of the problem is related to decision maker's multiple criterion evaluation in the light of alternatives. In this study, research assistants' performance evaluation is carried out by COPRAS method. The method of complex proportional assessment (COPRAS) developed by the authors aims at solving this problem. This method assumes direct and proportional dependence of the significance and utility degree of investigated versions on a system of criteria adequately describing the alternatives and on values and weights of the criteria. This study aims to solve performance determination problem of research assistants. A numerical example is given to demonstrate the applicability and effectiveness of the proposed approach. In the end ranking carried out by COPRAS method is given.

Keywords: COPRAS, Multi-criteria decision making, Research Assistant, Performance Evaluation

Introduction

In higher education institutions, enhancing research and teaching performance of faculty members is the essence of quality assurance systems. If an institution expects to improve and achieve its goals, performance must be measured and evaluated. In Turkish higher education system, there are significant problems in the evaluation system in which both purposes (summative and formative) are considered. For these reasons, such kind of things should be carried out:

- All state and foundation universities must adopt and apply the conception of strategic management and planning as a management approach.

- Proficiency fields and sub- proficiency fields with regard to professions of faculty members and performance indicators for each sub- proficiency field must be determined.
- Universities must develop evaluation models appropriate to their particular conditions by preferring more than one teaching performance evaluation method.
- Appropriate data collection tools must be developed for constructed teaching performance evaluation model/ models.

Due to these problems, it's obvious that studies on quality need to the quality and performance evaluation process needs to the performance (Kalaycı, 2009: 625-656).

Academic performance is a value compromised by taking into consideration different criteria. For academic performance to be evaluated, there aren't any method that can be digitized easily, evaluated on a common basis, flexible, easy to use. Academic performance evaluation problem is seen plausible to be modeled for multiple criteria performance evaluation problem due to uncertainty, just subjective evaluated criteria and hierarchic structure of criteria (Kaptanoğlu and Özok, 2006:194).

Multiple-criteria decision making is a field that contains mostly used part of decision theory. Multiple-criteria decision making also includes methods classifying and grouping of alternatives and making selections among alternatives.

Generally as criteria contradict each other, there is no solution that can satisfy all criteria at the same time. Mostly advantage of multiple criteria decision making problems is to evaluate criteria and alternatives at the same time. There are lots of multiple criteria decision making methods in literature such as AHP, TOPSIS, MOORA, ELECTRE, COPRAS and so on.

In our study, COPRAS method is foreseen as multiple criteria decision making method to appraise performance of research assistants.

COPRAS Method

COPRAS method was firstly introduced by Zavadskas and Kaklauskas as a multiple-criteria decision making method (Podvezko, 2011:137). COPRAS method uses stepwise ranking and evaluating procedure of alternatives in terms of significance and utility degree (Zavadskas et al. 2008: 241).

There are some studies about COPRAS method in literature. Some of them are as follows:

Zavadskas (2008) applied COPRAS to select constructor. Banaitiene et al. (2008) used COPRAS to evaluate life cycle of buildings. Yazdani et al. (2011) used COPRAS for risk assessment of construction projects. Zagorskas et al. (2007) analyzed city compactness by COPRAS. Chatterjee

and Chakraborty (2013) used COPRAS to select gear material. Zolfani et al. (2012) applied COPRAS G to determine quality manager. Yazdian et al. (2011) utilized this method for greenhouse locating selection.

The advantages of COPRAS method is lined up (Aksoy et al. 2015: 11):

• Compared with other methods such as AHP and TOPSIS, as it necessitates much less calculation than other methods COPRAS method is very easy to use.

• COPRAS method has the talent of calculating both maximizing and minimizing criteria.

• This method enhances to calculate both qualitative and quantitative criteria.

• The main advantage of COPRAS method compared with other multi criteria decision making methods is to be able to show utility degree. When compared alternatives, it can illustrate which one is better or worse.

COPRAS method consists of 7 stages. The stages of method is as follows (Popovic et al., 2012):

Stage 1. Construction of Decision Matrix

As in all multiple-criteria decision making problems first of all decision matrix is constructed. Decision matrix is as follows:

$$D = \begin{array}{c} A_1 \\ A_2 \\ A_3 \\ . \\ A_m \end{array} \begin{bmatrix} x_{11} & x_{12} & x_{13} & . & x_{1n} \\ x_{21} & x_{22} & x_{23} & . & x_{2n} \\ x_{31} & x_{32} & x_{33} & . & x_{3n} \\ . & . & . & . & . \\ x_{m1} & x_{m2} & x_{m3} & . & x_{mn} \end{bmatrix} \qquad (1)$$

Stage 2. The Normalization of Decision-Making Matrix

In order to transform performances of considered alternatives into comparable dimensionless values, normalization procedure is used. For normalization in COPRAS method the following formula is used:

$$\tilde{x}_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \qquad (2)$$

where x_{ij} is the performance of the i-th alternative with respect to the j-th criterion, $\tilde{x}_{ij}$ is its normalized value, and m is number of alternatives.

Stage 3. Determining of Weighted Normalized Decision-Making Matrix

After forming normalized decision making-matrix, the next stage is to determine weighted normalized decision-making matrix is constructed using following formula:

$$D' = d_{ij} = x_{ij}^{*} . w_j \qquad (3)$$

Stage 4. Calculation of Maximizing and Minimizing Index for Each Alternative

In this phase each alternative is categorized as maximizing and minimizing index by formula (4) and (5):

$$S_{i+} = \sum_{j=1}^{k} d_{ij} \quad \text{j=1,2,…..,k maximizing index} \qquad (4)$$

$$S_{i-} = \sum_{j=k+1}^{n} d_{ij} \quad \text{j=k+1, k+2…,n minimizing index} \qquad (5)$$

Stage 5. Calculation of the relative weight of each alternative

The relative weight Q_i of *i*-th alternative is calculated as follows:

$$Q_i = S_{+i} + \frac{\min_i S_{-i} \sum_{i=1}^{m} S_{-i}}{S_{-i} \sum_{i=1}^{m} \frac{\min_i S_{-i}}{S_{-i}}} \qquad (6)$$

Stage 6. Determine the priority order of alternatives

The priority order of compared alternatives is determined on the basis of their relative weight. The alternative with higher relative weight has higher priority (rank), and the alternative with the highest relative weight is the most acceptable alternative.

$$A^{*} = \left\{ A_i \middle| \max_i Q_i \right\} \qquad (7)$$

Stage 7. Calculation of Performance Index (P_i) Value for Each Alternative

In the last section, P_i values are calculated using following formula:

$$P_i = \frac{Q_i}{Q_{max}} .100\% \qquad (8)$$

The alternative having 100 degree is the best one. The ranking of alternatives is carried out from large to small.

Application: Performance Evaluation of Research Assistants By COPRAS Method

In the application stage, we evaluate the performance of research assistants taking charge in Pamukkale University.

To evaluate research assistant performance, we use 7 different criteria and 5 alternatives. These criteria are as follows: Undergraduate GPA, master degree GPA, PhD GPA, foreign language mark, master degree and PhD lesson completion duration, number of congress and number of essays.

First of all decision matrix is constructed as in Table (1):

Table 1. Decision Matrix

	Undergraduate GPA	Master Degree GPA	PhD GPA	Foreign Language Mark	. Master Degree and PhD Lesson Completion Duration	Number of Congress	Number of Essays
x_1	3.57	4	4	83.75	3	9	1
x_2	3.07	3.95	4	83	3	1	3
x_3	3.23	3.54	3.46	66	4	0	2
x_4	3.42	3.96	4	70	5	5	7
x_5	2.56	3.37	3.79	82	4	4	5

Normalized decision matrix is obtained by using Equation (2).

Table 2. Normalized Decision Matrix

	Undergraduate GPA	Master Degree GPA	PhD GPA	Foreign Language Mark	. Master Degree and PhD Lesson Completion Duration	Number of Congress	Number of Essays
x_1	0.225237	0.21254	0.207792	0.217674	0.157894737	0.473684	0.055556
x_2	0.193691	0.209883	0.207792	0.215724	0.157894737	0.052632	0.166667
x_3	0.203785	0.188098	0.17974	0.17154	0.210526316	0	0.111111
x_4	0.215773	0.210414	0.207792	0.181936	0.263157895	0.263158	0.388889
x_5	0.161514	0.179065	0.196883	0.213125	0.210526316	0.210526	0.277778

Weighted normalized decision-making matrix is constructed using Equation (3). All criteria is given same weight.

Table 3. Weighted Normalized Decision Matrix

	Undergraduate GPA	Master Degree GPA	PhD GPA	Foreign Language Mark	. Master Degree and PhD Lesson Completion Duration	Number of Congress	Number of Essays
x_1	0.032177	0.030363	0.029685	0.031096	0.022556391	0.067669	0.007937
x_2	0.02767	0.029983	0.029685	0.030818	0.022556391	0.007519	0.02381
x_3	0.029112	0.026871	0.025677	0.024506	0.030075188	0	0.015873
x_4	0.030825	0.030059	0.029685	0.025991	0.037593985	0.037594	0.055556
x_5	0.023073	0.025581	0.028126	0.030446	0.030075188	0.030075	0.039683

Maximizing and minimizing index values are calculated using Equation (4) and (5)

Table 4. Maximizing and Minimizing Index Values

	Si_+	Si_-
x_1	0.198926	0.022556391
x_2	0.149484	0.022556391
x_3	0.122039	0.030075188
x_4	0.209709	0.037593985
x_5	0.176985	0.030075188

Calculation of the relative weight of each alternative is carried out by Equation (6).

Table 5. Relative Weight of Each Alternative

	Q_i
x_1	0.233769239
x_2	0.184327335
x_3	0.148171631
x_4	0.230614871
x_5	0.203116924

Then the best Q_i value is selected according to Equation (7). That alternative is x1 as it can be clearly seen in Table 5. Lastly performance value index (P_i) is obtained by using Equation (8).

Table 6. Performance Value Index

	P_i
x_1	100
x_2	78.85012407
x_3	63.38371635
x_4	98.65064913
x_5	86.88778934

Ultimate ranking of alternatives is given at Table 7.

Table 7. Ultimate Ranking of Alternatives

x_1	100
x_4	98.65064913
x_5	86.88778934
x_2	78.85012407
x_3	63.38371635

As a result of evaluation of COPRAS method, it is determined that x_1 alternative has the best performance. On the other hand x_3 alternative has the worst performance.

Conclusion

It is highly important to evaluate performance of academic personnel for universities. The presence of academic personnel having high quality increases university efficiency and provides competition supremacy. There must be performance activities to increase having low performance.

In this study, 5 research assistant is analyzed by COPRAS method with undergraduate GPA, master degree GPA, PhD GPA, foreign language mark, master degree and PhD lesson completion duration, congress participated, number of essays data.

In the end, it is established that research assistant symbolized as x_1 has the best performance score. When we look into this research assistant, it can be seen that this research assistant has the highest undergraduate GPA, number of congress participated, foreign language mark on the other side this person has the lowest number of essays. It can be observed that x_3 has the lowest performance level. Having low performance level research assistant, x_3, has 2 essays and hasn't participated any congress. As a result this research assistant should be educated to increase performance.

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