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DEVELOPMENT OF AN ANALYTIC HIERARCHY PROCESS MODEL FOR FACULTY EVALUATION BASED ON PERFORMANCE CRITERIA

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ABSTRACT

Performance evaluation is a procedure of evaluating the work of the employees to recognize and utilize their competencies in connection to certain pre-established criteria and organizational objectives. It is often based on combined judgements or assessments periodically performed when faculty are rated against standards of performance. Performance evaluation of faculty members in a higher education is a serious challenge for faculty management. Several factors are considered leading to targeted professional growth of an organization to evaluate the performance. This task involves many selections that depends on different factors and judgement of these factors pose challenge in setting target values for all the output factors of the faculty. This study presents a multi-criteria model for faculty performance evaluation using Analytic Hierarchy Process (AHP). Different criteria affecting the performance evaluation of the faculty members were considered. In recent literature, AHP has been an emerging solution approach to complex real world multi-criteria decision making problems in order to assess the quality factors in evaluation need areas, measure the relative weight of each criterion, and to evaluate the overall performance evaluation. Based on these criteria, the performance of the faculty was evaluated and subsequently ranked.

Keywords: *Performance Evaluation, Performance Criteria and Sub-Criteria, Multi-Criteria Decision Making, Analytic Hierarchy Process*

1. INTRODUCTION

Evaluating performance of faculty members is one of the most critical activities or tasks within a school, and has become a priority worldwide (Bai, 2014). Defining appropriate methods to accomplish faculty evaluation has become a challenging issue for the universities. A number of performance parameters require consideration for effective decision making, since a number of performance parameters or factors require considerations.

Performance evaluation have been defined as a systematic procedure of evaluating an employee's work performance and effectiveness in connection to certain pre-established criteria (Felix Ola & Pallaniappan, 2013) broadly ranking from educational background (Bognanno & Melero, 2016), job experience, emotional intelligence and level of commitment (Long, Liu, Fang, Wang, & Jiang, 2018). The application of performance evaluation is an essential reason for performance improvement where strengths and weaknesses of faculty are reviewed and deliberated to recognize opportunities in view of establishing improvement and skills development (Ezema, Ezema, & Umezinwa, 2017). Some other important reasons include basis for employment decisions, like promotions in rank, career advancement, performance reward, sanctions, etc. (Pal & Pal, 2013).

In performance evaluation, it is important to recognize the different criteria and its priorities or level of importance in the performance evaluation. In recent years, the use of Analytic Hierarchy Process (AHP) technique have been gradually applied in multi-criteria decision making. AHP technique is a very powerful tool, which has wide applications in various fields of decision-making problems. (Calabrese, Costa, &

Menichini, 2013). AHP is a practical and effective method in solving multi-criteria decision problem (Govindan, Rajendran, Sarkis, & Murugesan, 2015; Ho & Ma, 2018; Wilson, Khazaei, & Hirsch, 2017). It allows the decision maker to represent the interactions between multiple criteria in complex situations. This technique requires the decision maker to develop a hierarchical structure for the criteria, which are explicit in the given problem, provide judgments about the relative importance of each of these criteria and specify a preference value for each decision alternative with respect to each considered criteria. It provides a prioritized ranking order indicating the overall preference for each of the decision alternatives (Uzoka, Okpokpo, & Fashoto, 2016).

In this paper, the researchers present a study on the implementation of AHP approach for faculty development regarding their performance on the basis of multiple factors or criteria. This study will be significant initially to the administrative level of the school then to the individual faculty members. Because majority of the data analysis work done is more emphasized on students' evaluation (Bhatnagar & Prashant, 2017), this research will provide additional insights about AHP in faculty performance evaluation.

2. MATERIALS AND METHODS

This paper proposed a model where all faculty performance criteria will be evaluated fairly in the performance evaluation process.

2.1 Data Collection

The primary data for the model was collected through the extraction and organization of the faculty performance data from the school's database. A questionnaire method was used to get data to determine how important a criterion is when comparing it with other criterion in the assessment of the faculty performance. The questionnaire was given to selected individuals as the respondents. The purpose of this research was made known to all the respondents and they were notified that participation is voluntary, the findings are purely for academic purposes and that the issue of their identities will remain confidential.

2.2 AHP Method

After the data is collected, an analysis is done on the data to be processed with AHP. There are several steps to using the AHP method (Deng, Hu, Deng, & Mahadevan, 2014) which was followed by the study is illustrated on Figure 1.

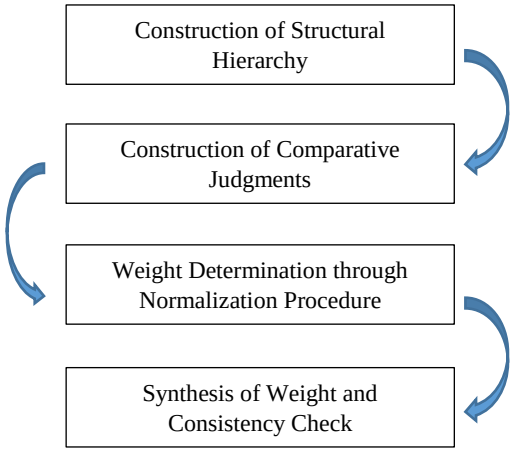

Figure 1. AHP Method

Step1. Construction of Structural Hierarchy where main goal or objective is highlighted and criteria and alternatives are identified.
Step2. Use a pair-wise comparison to evaluate its factors and determine the priority which represents the relative importance of one criterion to another criterion. It takes into one expert's preference by putting priority score in the form of matrix criteria, computing the choices and obtaining the percentage of each choice (Kumar & Gupta, 2018). The score for each criterion is based on 1-9 preferences where 1 is the least preferred and 9 is the most preferred.
Step 3. After constructing the pair-wise matrix, it needs to be normalized in order to obtain the priority of the criteria and also for consistency analysis. At this stage, the determination of the criteria weight is obtained from the division of the value of each number of rows with the number of criteria.
Step 4. After the relative priority weights (TPV) of the criteria have obtained, calculate the consistency ratio. The consistency test provides the validation and also the measurement of consistency among the pair wise comparison that have been throughout the judgment process. This calculation is used to ensure that the consistency ratio value (CR) <= 1.0. If it turns out the CR value is greater than 0.1, a pair-wise comparison matrix must be corrected.

3. RESULTS AND DISCUSSION

The purpose of this study is the development of a model, utilizing the AHP, which enables the decision-making process through defined relevant criteria.

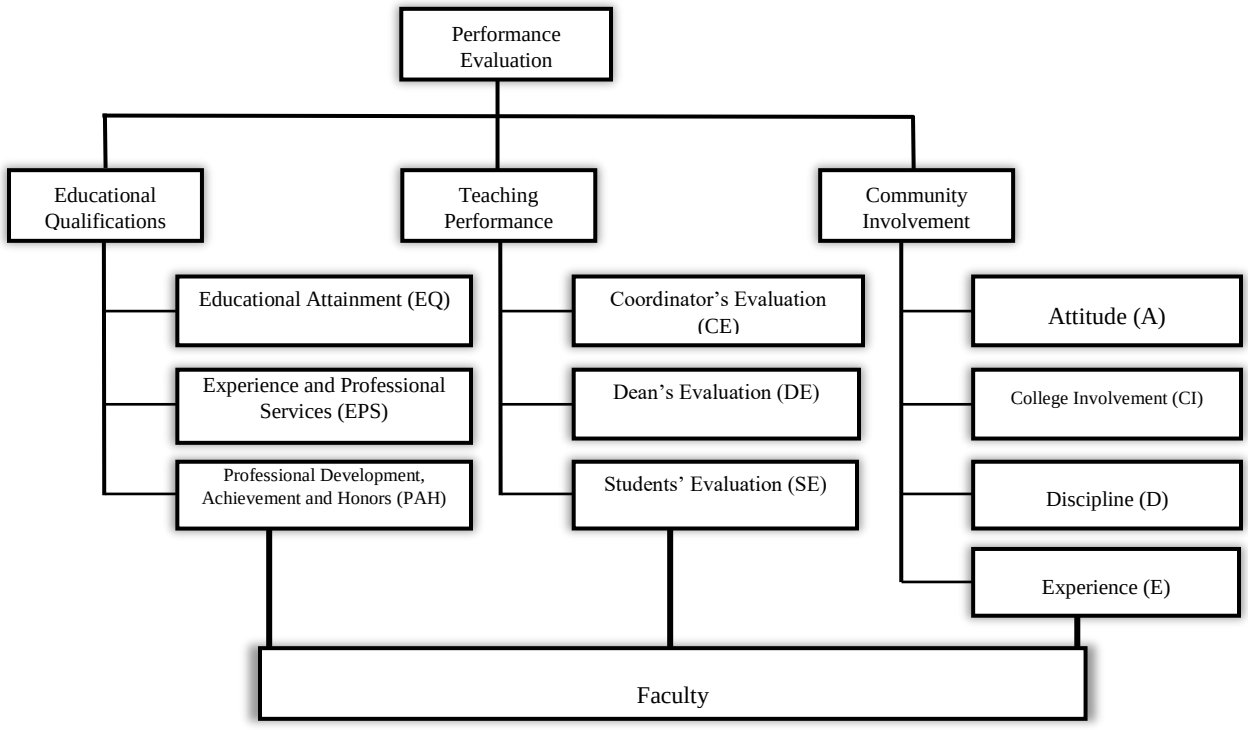

Figure 2. AHP Hierarchy Model with Goal, Criteria/Sub-Criteria and Alternative

The hierarchy model was developed in such a way that the goal is positioned at top, with criteria and sub-criteria on lower level and finally alternatives at the bottom of the model. The criteria used in the performance evaluation process consist of three criteria: Educational Qualifications (EQP), Individual Performance Evaluation (IPEP) and Community Involvement (CIP) as seen on Figure 2.

Table 1. Pair-Wise Comparison for Educational Qualification (EQP)

	EQ	**EPS**	**PAH**
EQ	1.0000	7.0000	0.5000
EPS	0.1429	1.0000	0.1250
PAH	2.0000	8.0000	1.000
Total	**3.1429**	**16.0000**	**1.6250**

Table 2. Pair-Wise Comparison for Individual Performance Evaluation (IPEP)

	CE	**DE**	**SE**
CE	1.0000	0.3333	4.0000
DE	3.0000	1.0000	5.0000
SE	0.2500	0.2000	1.0000
Total	**4.2500**	**1.5333**	**10.0000**

Table 3. Pair-Wise Comparison for Community Involvement (CIP)

	A	**CI**	**D**	**E**
A	1.0000	0.5000	2.0000	3.0000
CI	2.0000	1.0000	3.0000	2.0000
D	0.5000	0.3333	1.0000	0.5000
E	0.3333	0.5000	2.0000	1.0000
Total	**3.8333**	**2.3333**	**8.0000**	**6.5000**

The level of importance of each criterion using pair-wise comparison are described in Tables 1-3 of the data captured from the respondents on the three criteria and ten sub-criteria. Other elements of values were obtained by using the reciprocity relation a = 1/a. The pairwise comparison variables become a decisive factor in the decision making process (Calabrese et al., 2013).

Table 4. Total Priority Value, Rank and CR for Educational Qualification (EQP)

	EQ	EPS	PAH	TPV	Rank	Consistency Measure (λ max)
EQ	0.3182	0.4375	0.3077	0.3545	2	
EPS	0.0455	0.0625	0.0769	0.0616	3	CR = **0.0302**
PAH	0.6364	0.5000	0.6154	0.5839	1	

Table 5. Total Priority Value, Rank and CR for Individual Performance Evaluation (IPEP)

	CE	DE	SE	TPV	Rank	Consistency Measure (λ max)
CE	0.2353	0.2174	0.4000	0.2842	2	
DE	0.7059	0.6522	0.5000	0.6194	1	**CR = 0.0387**
SE	0.0588	0.1304	0.1000	0.0964	3	

Table 6. Total Priority Value, Rank and CR for Community Involvement (CIP)

	A	CI	D	E	TPV	Rank	Consistency Measure (λ max)
A	0.2609	0.2143	0.2500	0.4615	0.2967	2	
CI	0.5217	0.4286	0.3750	0.3077	0.4083	1	**CR = 0.0494**
D	0.1304	0.1429	0.1250	0.0769	0.1188	4	
E	0.0870	0.2143	0.2500	0.1538	0.1763	3	

Tables 4-6 show the resulting weights and ranks for the criteria based on the pair-wise. Each entry in the column (C) is divided by the corresponding column total ($\sum C$) to get the normalized score (C_n / $\sum C$). Eigenvector is obtained by calculating Total Priority Value (TPV) to get the relative priority weight of each sub-criteria. In this process, the identification of the criteria weight is obtained from the division of the value of each number of rows with the number of criteria $\sum$ R / *n*, where *n* is the number of criteria or element. The Consistency Ratio value of all the criteria is less than 10%.

4. CONCLUSION

In this study, an AHP model was developed in order to measure and weight the factors or criteria in performance evaluation and to evaluate the overall performance evaluation. Based on the computed Consistency Ratio per criteria which is less than 10%, the researchers concluded that the consistency of

the final performance evaluation results is declared correct. By using the AHP methodology, faculty can be ranked by considering all required criteria. The ranking can assist the school to select the best faculty members based on their ranking points. The authors suggest or recommend to conduct further research on other methodologies or combine other methodology in the faculty performance evaluation. This AHP model can be used in the development of a decision support system.

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