AN EVALUATION OF THE PERFORMANCE OF ENGINEERING DEPARTMENTS IN A TURKISH UNIVERSITY

Ugur Ozcan
Gazi University

Ismet Soylemez
Abdullah Gül University

Ahmet Dogan
Osmaniye Korkut Ata University

Abstract: In educational institutions, performance efficiency of the departments should be reviewed within the context of continuous development and improvement activities. An effective performance evaluation system enables the use of resources in the most effective manner. One indication representing the development level of a country is the scientific knowledge. Engineering departments play a critical role in increasing the scientific knowledge of a country. So, in this study, a Multiple-Criteria Decision Making (MCDM) approach is proposed for the performance evaluation of the engineering departments in a Turkish University. The Analytical Hierarchy Process (AHP) is used to determine the relative criteria weights and The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method is applied to prioritize and rank those departments. The performance criteria considered in this study are student ratio (undergraduate, postgraduate and doctoral student), research publications, number of master theses and doctoral theses completed, academic staff, total achievement scores and so on. The results obtained from this study, Decision Makers could see the performance efficiency of the engineering departments in an easier way and taking appropriate measures will provide continuous improvement within the scope of the development of this department.

Keywords: Engineering department, technical education, MCDM, AHP, TOPSIS.

Introduction

In our country, after health related departments, engineering faculty departments attract the attention as the most preferable area. Number of graduated students from engineering faculties has been increasing with the increasing choices of these faculties. Choice of engineering department gains much importance after high school education in our country in which graduation field and job finding ratio are closely related.

For this study, 5 departments continuing to education in Gazi University Faculty of Engineering were considered. These departments are industrial, civil, mechanical, electrical and electronics and chemical engineering. It is aimed to detect which department or departments are more preferable by comparing them according to determined criteria. The performance criteria considered in this study are student ratio (undergraduate, postgraduate and doctoral student), research publications, number of master theses and doctoral theses completed, academic staff and total academic achievement scores.

This paper organizes as follows: in the next section, information is given about utilized methods. Case study is presented in the third section of the study. And in the last section, conclusion and a general evaluation is done.

Methodology

For this study, AHP and TOPSIS methods were chosen among multi criteria decision making methods. The results obtained by these two methods were compared.

AHP is one of the most used methods among MCDM methods. It was developed firstly by Saaty in 1970s. Packaged software programs were developed for solution of AHP. Superdecision, one of these software programs, was used in implementation stage of the study.

Steps of AHP as follows [1]:

Step 1: Determination of the goal, criteria and alternatives.
Step 2: data collection from related resources or decision makers.
Step 3: Determination of the relationship of criteria weights.
Step 4: Calculate the degree of consistency.
Step 5: Calculate alternatives scores.

TOPSIS was revealed by Hwang and Yoon in 1980s. For implementation section of this study, Excel was used and calculations were realized.

TOPSIS steps are given below:

Step 1: Decision matrix construction
Step 2: Normalized deicison matrix construction
Step 3: Weigheted normalized decision matris construction
Step 4: Calculating the positive and negative ideal solution
Step 5: Calculating the distance of each alternative to the positive and negative ideal solution
Step 6: Calculating the relative proximity
Step 7: Rank tke altenatives according to their relative proximity

The Case Study

In this paper, five different departments of engineering are considered. Related criteria are determined in detail. Student ratio: The number of undergraduate, postgraduate and doctoral students are calculated from Gazi university information databases. number of master theses and doctoral theses completed: This information is collected [3]. Number of academic staff: each departments web pages is used during the data collection. Total academic achievement scores: Total academic achievement scores of every department were taken [4]. For calculation of the total score, only the instructors who have academic score above 30 points were considered. Since the data is not shared by the university, any information about the instructors who are under 30 points could not be taken. Research Publications: The number of academic studies realized by people who take parts in education and teaching activities in the departments were reached from www.scopus.com address by using the determined key words. The key words for the search are as below:

Table 1. Keywords for departments

Departments	Keyword-1	Keyword-2		Keyword-3		
Electrical and Electronic Engineering	gazi university	faculty engineering	of	electrical and electronic engineering		
Industrial Engineering	gazi university	faculty engineering	of	industrial engineering		
Civil Engineering	gazi university	faculty engineering	of	civil engineering		
Chemical Engineering	gazi university	faculty engineering	of	chemical engineering		
Mechanical Engineering	gazi university	faculty engineering	of	mechanical engineering		

Hierarchical representation of decision making problem is as below. The aim is to select the suitable one among the engineering faculty departments.
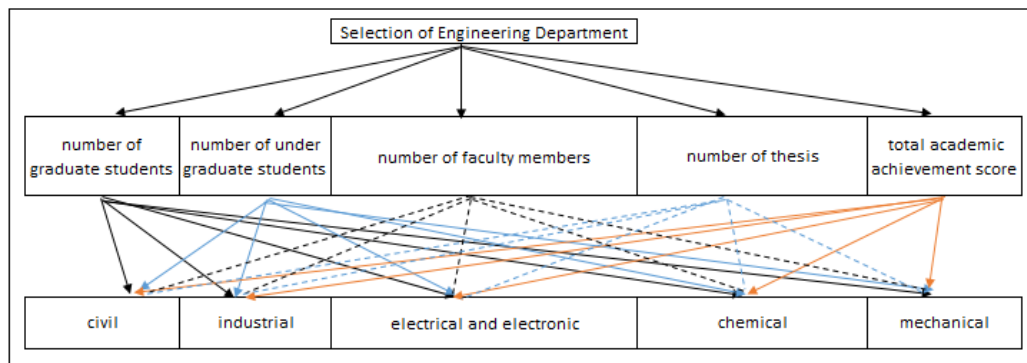
Figure 1. Hierarchy model of evaluation of the engineering departments

To determine weights of the criteria, collected data was evaluated. The obtained data is as below. In this table, total faculty member number, postgraduate student number, academic articles average number for each faculty member, thesis and academic score numbers are given. These values were used for calculating weights of the criteria.

Table 2. Collected data for criteria

Departments	faculty members	graduate students	academic paper	thesis	achievement scores
Electrical and Electronic Engineering	36	499	10,61	0,58	17,72
Industrial Engineering	49	833	9,84	0,38	12,51
Civil Engineering	45	783	7,04	0,40	9,49
Chemical Engineering	48	896	15,71	0,33	15,62
Mechanical Engineering	54	1067	12,11	0,45	24,42

Looking at AHP results obtained by Superdecision packaged software, it is seen that the most preferable department is electrical and electronics engineering. The most second preferable department is mechanical engineering; and then industrial, chemical and civil engineering departments, respectively. When we look at the results obtained by TOPSIS method, different results were obtained from AHP method. The most preferable department is mechanical engineering and the second one is electrical and electronics engineering. The third one is chemical engineering, the fourth one is industrial engineering and the last one is civil engineering.

Table 3. Results of AHPand TOPSIS for alternatives

Departments	AHP Scores	TOPSIS scores
Electrical and Electronic Engineering	0,334	0,545
Mechanical Engineering	0,304	0,642
Civil Engineering	0,031	0,322
Industrial Engineering	0,236	0,425
Chemical Engineering	0,095	0,543

As it can be understood from the graph given, the most preferable department considering the result obtained with AHP method is electrical and electronics engineering. According to TOPSIS method, mechanical engineering is the most preferable one.
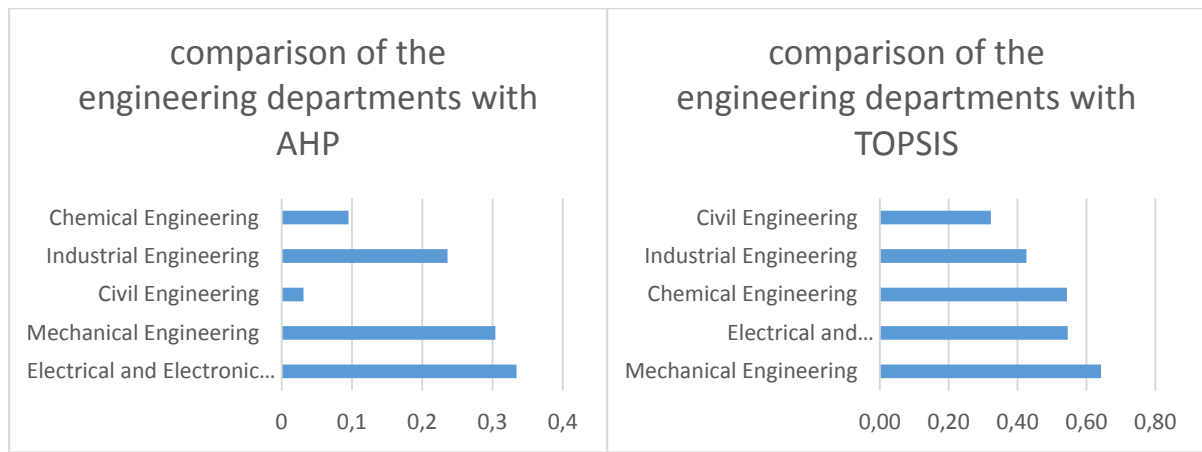
Figure 2. Comparison of the engineering departments with AHP and TOPSIS

Conclusion

AHP and TOPSIS was used for comparison of the five different departments of engineering. Looking at the obtained results, it was found which alternative is more important for the decision maker according to the determined criteria. For this departments, the most suitable alternative is Electrical and Electronic engineering for Analytical Hierarchy Process and Mechanical engineering for Technique for Order of Preference by Similarity to Ideal Solution.

References

file:///C:/Users/ismet/Downloads/9781852337568-c1.pdf.

Ranjan R., Prasenjit C. and Shankar Chakraborty, 2015. Evaluating performance of engineering departments in an Indian university using DEMATEL and compromise ranking methods. OPRESEARCH. 52(2), 307-328.

https://tez.yok.gov.tr/UlusalTezMerkezi/, access date: 5 April 2016.

http://gazi.edu.tr/posts/view/title/akademik-tesvik-odenegi-kesin-sonuc-listesi-148065, access date: 5 April 2016.