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Ranking of Faculties by Double Frontiers DEA and Traditional DEA (AP) Methods (Case Study: Faculties of Yazd University)

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Abstract

Background/Objectives: In this research, we have tried to describe an appropriate mathematical model of Data Envelopment Analysis for ranking of Yazd University faculties from the perspective of DEA model. **Methods/Statistical Analysis:** In this study, after identifying factors affecting faculty efficiency (number of teachers, number of students, university staff, presented books and papers, etc.) and determining the subdivisions of each of the factors, the relative significance of each factor of the subdivisions was calculated with the AHP method and the most important factors were used as the DEA model inputs. **Results:** After the implementation of the two models of traditional DEA and DEA with double frontiers, the results indicate that the ranking of faculties is different in each of these two methods and the traditional method of Data Envelopment Analysis has been more efficient in this research. **Conclusion/Application:** The result of this study suggest that in the ranking of the faculties there is a difference in between the two methods of traditional DEA and DEA with double frontiers in terms of efficiency.

Keywords: AP Ranking, Data Envelopment Analysis (DEA), Decision Making Unit (DMU), DEA with Double Frontiers, Efficiency

1. Introduction

Performance evaluation and measurement has long been taken into consideration by people around the world. In fact, performance evaluation is a process that begins with the birth of a human being who seeks to reform and improve individual performance. People of all ages and eras have encountered a problem called resource constraints and limitations of production facilities. Due to the rising public expectations of economic prosperity, the demand for goods and services has had an upward trend and is increasing almost infinitely. Now considering the limited resources and facilities and the growing increase in consumption of goods and services, maximum use of existing facilities is one of the most substantial possible solutions to reduce the gap between supply and demand[1]. In our current time, dramatic developments of management knowledge have made the existence of evaluation systems inevitable such that it regards the absence of evaluation system in different aspects of an organization including the evaluation of the use of resources, facilities, objectives and strategies of managers and employees as one of the symptoms of diseases in the organization. The lack of an evaluation system and control of a system

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means the absence of communication with an organization's internal and external environment which is the consequence of decline and ultimately death of the organization. On the other hand, in order to determine the utility of an activity in its subdivisions, every organization needs an evaluation system for the assessment of this utility. National University of Yazd as an organization is no exception to this rule[2].

Every system or organization has specific, predetermined goals. System or organizational management seeks to achieve these goals using resources and facilities. Evaluating the achievement of objectives and the use of resources and facilities plays an essential role in this regard. In fact, performance evaluation is viewed as the core of management activities and measures. Since management needs to be aware of its division's performance for the guidance of its subordinates in order to be able to adopt strategies based on this information. Although, nowadays, performance improvement is immensely taken into account in organizations, yet without an efficient and effective performance evaluation system any attempt to improve performance would be useless[3]. In addition, one of the main indices for measuring the development of countries is the share of a country in the production of knowledge. Hence, performance evaluation of education systems and consequently their performance improvement have found two fold significance. Considering the role and importance of performance evaluation system and the absence of a performance evaluation system at Yazd University, the use of an efficient and effective method and that of a mathematical type as well might be very useful. Therefore, this research seeks to evaluate efficiency of the university faculties by using the method of DEA with double frontiers and the traditional models of DEA and compare the results obtained from the implementation of the two mentioned methods where the results achieved from implementing the Anderson-Peterson model in this study were more logical. The purpose of conducting this research is to rank the faculties of the National University of Yazd on the basis of their efficiency level using the two methods of DEA with double frontiers and traditional DEA and to compare the results obtained from the implementation of the two methods of DEA with frontiers and traditional DEA. To achieve this objective, we have utilized the assumption that in the ranking of the faculties of Yazd National University there is no difference with respect to efficiency between the method of DEA with double frontiers and the method of traditional DEA and subsequently, by considering the main questions of this research, the faculties have been ranked in terms of efficiency and the difference between the two principal methods of the research has been evaluated.

2. Research Background and Theoretical Framework

Efficiency measurement has always been of interest to researchers because of its importance in performance evaluation of a firm or organization. In 1957, Farrell attempted to measure efficiency of a production unit using a method like efficiency measurement in the topic of engineering. Efficiency is the ratio of the actual return obtained to the expected return; in other words, the ratio of the amount of work done to the amount of work that must be done[4]. The Data Envelopment Analysis is a linear-programming-based technique applied for relative efficiency evaluation of similar Decision Making Units with multiple inputs and outputs[5]. A Decision Making Unit (DMU) is an institution responsible for the use of resources (inputs) to produce outputs. In this research, each of the faculties of Yazd National University has been intended as a DMU. Anderson-Peterson (AP) ranking Model is used for the ranking of efficient units after the implementation of the DEA model. In the said method of DEA with double frontiers, in addition to defining the efficiency frontier, an inefficiency frontier is defined as well and afterwards by considering the existing double frontiers the DMUs are ranked[6].

Numerous studies have been carried out on performance evaluation and ranking with the use of the Data Envelopment Analysis some of which are pointed out here. In a research conducted by Avkiran in 2001 on 36 academic units in Australia, three categories of educational, financial and total outputs were separately evaluated and considering the reduction of the number of outputs in the execution of the three models led by their combination, the decrease of efficiency rating in some units and stability of rating in some others were perceived and its root causes were addressed[7]. In 2002, using data from 112 universities, Thursby and Kemp after the execution of the DEA model examined the correlation between the increase in inputs, increase in efficiency rating and extraction of inefficiency root causes by means of statistical methods[8]. Bifulco and Bretschneider carried out a research in 2001 using the two methods of DEA and COLS based on measuring the observational errors and

separating them from inefficiencies in twelve groups of data and outputs with a nonlinear relationship. Banker et. al. in 2003 evaluated the existing efficiency of schools in the west, southeast and north of the state of Texas and determined schools with first to thirds ranks. The result of this research is indicative of a direct relationship between inefficiency and variable costs[9]. Shahriari in a survey has sought to rank schools based on a fuzzy DEA model and using data profile method and eliminating their substitution property[10].

2.1 Anderson and Peterson (AP) Method

Anderson and Peterson proposed a new method for ranking efficient units such that the PTH decision making unit is evaluated while the smaller limit equal to zero related to the same decision making unit is removed from the prototype. For further explanation, the relative CCR model is taken into consideration[11].

$$MaxZ_p = \sum_{r=1}^{s} u_r y_p \quad (1)$$

s.t:

$$\sum_{i=1}^{m} v_i x_{ip} = 1 \qquad (i=1,\ldots,m)$$

$$\sum_{j=1}^{m} u_r y_{rj} - \sum_{j=1}^{n} v_i x_{ij} \leq \circ \qquad (j=1,\ldots,n)$$

$$u_r, v_i \geq \circ \qquad (r=1,\ldots,s)$$

For the ranking of units with the efficiency equal to one, Anderson and Peterson suggested that the smaller limit equal to zero related to the decision making unit under assessment should be removed from the model in which case the relative CCR model will be adjusted in the following form:

$$MaxZ_p = \sum_{r=1}^{s} u_r y_{rp} \quad (2)$$

s.t:

$$\sum_{i=1}^{m} v_i x_{ip} = 1 \qquad (i=1,\ldots,m)$$

$$\sum_{\substack{j=1 \\ j\neq p}}^{n} u_r y_{ri} - \sum_{\substack{j=1 \\ j\neq p}}^{n} v_i x_{ij} \leq \circ \qquad (j=1,\ldots,n) \qquad j \neq p$$

$$u_r, v_i \geq \circ \qquad (r=1,\ldots,s)$$

2.2 Method of DEA with Double Frontiers

Another method which can be used for the ranking of DMUs is the method of DEA with double frontiers. This method is unlike traditional methods of DEA such as Cross-efficiency and is easy to execute and implement without imposing any weight restrictions on the model. It should be noted that the above-mentioned method resolves the short comings of the AP method such as instability and implausibility of the issue and by defining an inefficiency frontier in addition to the efficiency frontier for the DMUs, the overall performance of DMUs is calculated and then ranked with regard to these double frontiers[12].

DEA method with double frontiers is as follows.

In this method similar to traditional DEA, an optimistic efficient frontier is defined. Imagine that we have **n** decision making units which contain **m** inputs and **s** outputs. As a consequence, X_{ij} (i =1,...,m) stands for DMU_j inputs where j = (1,...,n) and $y_{r\ j}$ (r =1,...,s) represents DMU_j outputs. Therefore, DMU_j efficiency is defined as thus.

$$\theta_j = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}}$$

In the above equation, u_r^* and V_i^* are the weights allocated to outputs and inputs.

The fraction model of the above equation is as the following.

$$Max\theta_\circ = \frac{\sum_{r=1}^{s} u_r y_{r\circ}}{\sum_{i=1}^{m} v_i x_{i\circ}}$$

$$j=1,\ldots,n \ \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 \quad \text{s.t:}$$

s.t:

$$r=1,\ldots,s \qquad i=1,\ldots,m \qquad u_r, v_j \geq \circ$$

Thus, fraction programming conversion into linear programming of the following model is obtained.

$$Max\theta_\circ = \sum_{n=1}^{s} u_r y_{r\circ}$$

$$\sum_{i=1}^{m} v_i x_{io} = 1 \text{s.t}$$

$$j = 1,\ldots,n \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i z_{ij} \leq \circ$$

$$r = 1,\ldots,s \qquad i = 1,\ldots,m \qquad u_r, v_j \geq \circ$$

The above problem is solved n times for DMUs and the obtained points form the hypothesis of optimistic efficiency. Next, we calculate the method of DMU with double frontiers of pessimistic efficiency as below.

$$Min\ \rho_{\circ} = \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}}$$

$$j = 1,\ldots,n \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \geq 1 \text{s.t}:$$

$$r = 1,\ldots,s \qquad i = 1,\ldots,m \qquad u_r, v_j \geq \circ$$

After converting the above mentioned model into the model of linear programming, the following model is achieved.

$$Min\ \rho_{\circ} = \sum_{r=1}^{s} u_r y_{ro}$$

$$\sum_{i=1}^{m} v_i x_{io} = 1 \text{s.t}:$$

$$j = 1,\ldots,n \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \geq \circ$$

$$r = 1,\ldots,s \qquad i = 1,\ldots,m \qquad u_r, v_j \geq \circ$$

If there is a positive set of u_r^* and V_i^*, for which $\rho_{\circ}^*$ is equal to one, the said points form the inefficiency frontier. In the next stage, the total performance (efficiency) is calculated.

$$j = 1,\ldots,n\ \eta_j = \frac{\theta_j^*}{\sqrt{\sum_{i=1}^{n} \theta_i^{*\,2}}} + \frac{\rho_j^*}{\sqrt{\sum_{i=1}^{n} \rho_i^{*\,2}}}$$

After evaluating the total performance of DMUs, they can be ranked accordingly. The above said method may be used in various research fields like the induction and selection of manufacturing technology[12]. According to the above points, it is recommended that the mentioned method should be used for efficiency evaluation of DMUs (faculties). Thus in this research, the results obtained from the implementation of the two methods are compared (Figure 1).

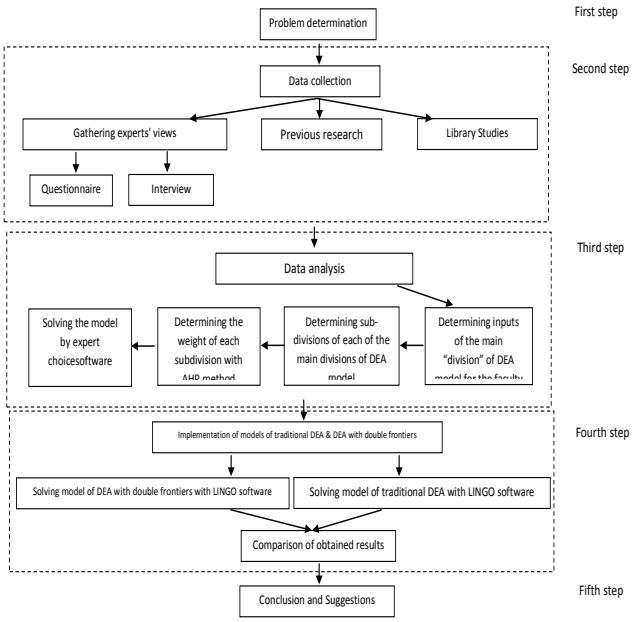

Figure 1. Stages of research implementation.

3. Research Methodology

The current research was conducted with a research approach in the National University of Yazd and during 2004-2008. In order to carry out the intended research, 9 faculties were selected as follows.

1 – Faculty of Humanities, 2 – Faculty of Basic Sciences, 3 – Faculty of Engineering, 4 – Faculty of Arts and Architecture, 5 – Faculty of Literature, 6 – Faculty of Mathematics, 7 – Faculty of Desertology, 8 – Faculty of Theology in Meybod, 9 – Faculty of Natural Resources in Ardakan.

First, for the identification of factors affecting the efficiency of faculties, library studies have been selected and

after studying research literature and interviewing experts and university scholars, the factors affecting the efficiency of faculties were identified. These factors are as described in Table 1.

Of the identified factors, the following factors were selected due to their integrity and accessibility.

1–Number of teachers, 2–Number of students, 3–Published books and papers, 4–Educational-welfare facilities, 5–Number of Academic and non-academic staff, 6–Revenue from academic research.

It must be noted that the above factors will be used as the main inputs of the DEA model in which each factor is a principal division and has a number of subdivisions that will in turn be explained in detail.

In the next step, in order to determine the most effective factors, the AHP method was used. According to the AHP approach, we will have a 3-level hierarchical tree where the three levels are:

Level1–Objective: Determining the most important factors affecting the performance of faculties.

Level2–Main criteria of Yazd University faculties.

Table 1. Previous research

Factors identified as input of DEA model	Country	Research Year
Number of teachers,allocation of facilities to each educational program, education fee per student, teaching hours	Australia	1999
Number of undergraduate students, graduate students, university staff, education budget	England	2005
Number of students, Board of Education, educational funding, educational programs	Turkey	2008
Number of faculty members,industrial and federal research, innovations and inventions	America	2007
Number of students, Number of university staff, education budget	Germany	2007

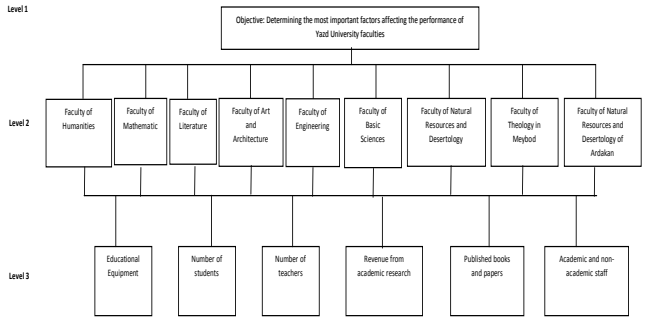

Figure2

Level3– Options which comprise the identified factors here.

The above mentioned contents can be outlined in Figure 2.

According to the AHP method, 9 matrices of 6×6 must be formed for paired comparisons so that significance coefficient of each of the options is determined with respect to the criteria. Additionally, we will have a 9×9 matrix of paired comparisons that depicts the significance coefficient of the criteria in terms of objective. Thus in order to obtain expert opinion on the factors and their significance, the questionnaire was disseminated. After collecting the questionnaires, the geometric mean of the scores given to each factor by the subjects was calculated and the obtained results were inserted into the table of AHP paired comparisons and the model was solved with expert choice[11] software. The results achieved from solving the model by the software may be expressed in two ways as presented in Table 2.

According to the obtained results, the three factors of teachers, students and educational-welfare facilities contain the highest weight and are selected as the main factors to use in the DEA model.

3.1 Traditional DEA Model

Since in the current research, the focus is on model inputs, the DEA model used in this research is the BCC model. It should be noted that this model is solved by LINGO software and the selected main factors are each a main division having a subdivision as follows.

Table 2. The results from solving the model by the software

Revenue from academic research	Yazd University staff	Published books and papers	Educational welfare facilities	Students	Teachers	Options
0.07616	0.09909	0.05919	0.18012	0.3179	0.2675	Significance

Table 3. Number and academic rankof faculties

Academic rank					Number of teachers	Name of Faculty	Number
Full P rofessor	Associate Professor	Assistant Professor	Educator	Senior			
		50		31	81	Humanities	1
1	1	27		6	35	Basic Sciences	2
		2		2	22	Mathematics	3
		77	1	32	110	Engineering	4
	1	15		9	25	Desertology	5
		5		14	19	Art and Architecture	6
		6	1	1	8	Theology of Meybod	7
				2	2	Natural Resources of Ardakan	8
		23		5	28	Literature	9

1. Teachers: in the present study, by teachers we mean the faculty members of the university that comprise two subdivisions called the number of teachers and the academic rank of teachers, as demonstrated separately for each faculty in Table 3.

2. Students: consist of two subdivisions named the number of students and the GPA of students, as specified separately for each faculty in Table 4.

Table 4. Number and GPA of faculty students

GPA of students	Number of students	Name of Faculty	Number
15.75	2287	Humanities	1
15	642	Basic Sciences	2
15.026	558	Mathematics	3
14.472	2407	Engineering	4
15.20	379	Desertology	5
16.114	404	Art and Architecture	6
16.184	237	Theology of Meybod	7
15.794	145	Natural Resources of Ardakan	8
15.49	566	Literature	9

3. Educational-welfare facilities: includes two subdivisions called the educational space allocated to each student and educational equipment; the number allocated to each faculty is depicted in Table 5.

The output of the DEA model in the present study is the number of graduates and published books and papers. Their numbers are shown separately for each faculty in Tables 6 and 7.

Table 5. Budget allocated to faculties

Sum (Iranian Rial)	Name of Faculty	Number
25,000,000	Faculty of Engineering	1
20,000,000	Faculty of Basic Sciences	2
20,000,000	Faculty of Mathematics	3
15,000,000	Faculty of Humanities	4
15,000,000	Faculty of Literature	5
15,000,000	Faculty of Theology in Meybod	6
15,000,000	Faculty of Humanities	7
15,000,000	Faculty of Art and Architecture	8
10,000,000	Faculty of Natural Resources of Ardakan	9

Table 6. Number of graduates of faculties

Number of graduates	Faculty	Number
442	Humanities	1
59	Theology of Meybod	2
73	Desertology	3
104	Faculty of Basic Sciences	4
386	Faculty of Engineering	5
93	Art and Architecture	6
112	Literature	7
93	Mathematics	8
57	Natural Resources of Ardakan	9

Table 7. Number of published books and papers of faculties

Published books and papers	Faculty	Number
13	Humanities	1
3	Literature	2
10	Basic Sciences	3
5	Mathematics	4
12	Engineering	5
5	Desertology	6
2	Art and Architecture	7
1	Theology of Meybod	8
-	Natural Resources of Ardakan	9

1. The weight allocated to the academic rank of teachers is as presented in Table 8.

Table 8. Weights of teachers' ranks

Allocated Weight	Rank	Row
3	Senior	1
5	Educator	2
10	Assistant Professor	3
15	Associate Professor	4
20	Full Professor	5

2. Every input of the DEA model is a main division whose subdivisions constitute the main division. Divisions and subdivisions of the model may be depicted in Figure 3.

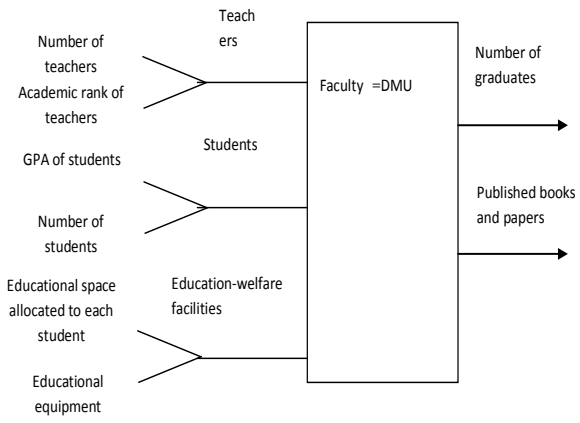

Figure 3

4. Results Obtained from Model Implementation and Data Analysis

After implementing the traditional DEA model, the achieved results were displayed in Table 9.

Table 9. Output of traditional DEA model

Efficiency	Faculty
1	Humanities
1	Basic Sciences
0.93	Engineering
1	Desertology
0.8	Theology of Meybod
1	Art and Architecture
0.88	Literature
0.87	Mathematics
1	Natural Resources of Ardakan

Since 5 of the faculties have the efficiency of 1 and are on the efficiency frontier, Anderson-Peterson ranking model has been used for ranking efficient units and determining the most efficient faculty whereby the results obtained from its implementation are presented in Table 10.

Table 10. Output of AP model

Efficiency	Faculty
1.9	Humanities
1	Basic Sciences
1	Desertology
1	Art and Architecture
2	Natural Resources of Ardakan

Based on the achieved results, it can be concluded that the faculty of Natural Resources of Ardakan is the most efficient faculty.

The model of DEA with double frontiers: in the method of DEA with double frontiers, in addition to defining the efficiency frontier, a non-efficiency frontier is also described for DMUs and, afterwards, by considering these double frontiers, efficiency is calculated whereby the results obtained from the implementation of the model and solution of it through LINGO software are as presented in Table 11 and 12.

Table 11. Optimistic frontier

Efficiency	Faculty	Number
1	Humanities	1
1	Basic Sciences	2
1	Engineering	3
1	Desertology	4
1	Theology of Meybod	5
1	Art and Architecture	6
1	Literature	7
0.90	Mathematics	8
1	Natural Resources of Ardakan	9

Table 12. Pessimistic frontier

Efficiency	Faculty	Number
1	Humanities	1
1	Basic Sciences	2
1	Engineering	3
0.94	Desertology	4
0.77	Theology of Meybod	5
0.87	Art and Architecture	6
0.89	Literature	7
0.87	Mathematics	8
1	Natural Resources of Ardakan	9

According to these double frontiers, efficiency of the faculties is as Table 13.

Table 13. Output of model of DEA with double frontiers

Efficiency	Faculty	Number
0.68	Natural Resources of Ardakan	1
0.6	Theology of Meybod	2
0.66	Desertology	3
0.68	Basic Sciences	4
0.68	Engineering	5
0.6909	Art and Architecture	6
0.648	Literature	7
0.608	Mathematics	8
0.706	Humanities	9

Based on the results achieved from solving the model with LINGO software, ranking of the faculties using the model of DEA with double frontiers is as Table 14.

Table 14. Ranking of faculty using DEA model with double frontiers

Rank	Faculties
1	Humanities
6	Basic Sciences
6	Engineering
7	Art and Architecture
4	Literature
2	Theology of Meybod
6	Natural Resources of Ardakan
3	Mathematics
5	Desertology

After implementing the model of traditional DEA and solving the model with the software, the efficiency of the faculties was calculated. The obtained results indicate that the 5 faculties of Humanities, Basic Sciences, Desertology, Art and Architecture and Natural Resources of Ardakan have the efficiency of 1 and are on the efficiency frontier and the 4 faculties of Engineering, Theology of Meybod, Literature and Mathematics are far from the efficiency frontier and are the inefficient units in this research. After the implementation of the model of DEA with double frontiers and the solution of the model with the software, the optimistic efficiency of the faculties was calculated. In the method of DEA with double frontiers, those faculties with the highest efficiency are known as the efficient faculties and the rest of the faculties are known as the inefficient units; thus in the present research, the faculties of Humanities, Theology of Meybod, Mathematics and Literature are known as the efficient units and the rest of the faculties are known as the inefficient units.

4.1 Presenting Some Strategies for the Increase of Efficiency of the Inefficient Faculties in the Traditional DEA Model

The first inefficient faculty in the traditional DEA model is the Faculty of Engineering with the efficiency of 93%. Based on the results achieved from the sensitivity analysis model, it is suggested that the section of students, viewed as one of the inputs of the DEA model, be more taken into consideration. The rise in the overall GPA of the students of the Engineering Faculty leads to the conversion of the faculty into an efficient one. A second faculty identified as an inefficient faculty is the Theology Faculty of Meybod with the efficiency of 0.8. For the enhancement of its

efficiency, it is recommended that focus be more given to the educational-welfare facilities and the educational equipment of this faculty be expanded as much as possible. It is noteworthy to state that although the model used in this research is an input-based model and concentration is higher on the inputs, yet the efficiency of the faculty may be increased by the expansion of books and papers utilized in the present study as the outputs. The third inefficient faculty in the current research is the Faculty of Literature with the efficiency of 88%. On the basis of the results obtained from the sensitivity analysis model, it is suggested that focus be more on the students. Increase in the overall GPA of the students paves the way for the conversion of the inefficient Faculty of Literature into an efficient faculty.

The last inefficient faculty in this research is the Faculty of Mathematics with the efficiency of 87%. According to the data of the previous chapter, the suggestion is more concentration on the section of teachers. Using teachers with the academic ranks higher than Assistant Professor and increase in the number of teachers with Doctorate degrees as much as possible pave the way for the conversion of the faculty into an efficient one.

4.2 Presenting some Strategies for Increasing Efficiency of Inefficient Faculties in Model of DEA with Double Frontiers

The first inefficient faculty in the method of DEA with double frontiers is the Faculty of Engineering. Based on the results obtained from the sensitivity analysis model, in the event of an increase in the overall GPA of students of this faculty, it can be expected that this faculty might join the efficient faculties.

Another inefficient faculty in the method of DEA with double frontiers is the Faculty of Natural Resources of Ardakan for the efficiency of which it is recommended that more attention be given to the section of teachers. Using teachers with Doctorate degrees and also increasing the number of published books and papers may convert this faculty into an efficient one in the method of DEA with double frontiers.

Another faculty identified as an inefficient faculty in the method of DEA with double frontiers is the Faculty of Basic Sciences. To increase the efficiency of this faculty, it is suggested that more concentration be on the section of educational-welfare facilities. The expansion of equipment can pave the way for the conversion of the inefficient unit into an efficient one in this method.

The last inefficient faculty in the method of DEA with double frontiers is the Faculty of Arts and Architecture. For the enhancement of the efficiency of this faculty, it is suggested that more attention be given to the two sections of educational equipment and students. Enhancing the educational equipment as much as possible and increasing the GPA of students have considerable effect on the expansion of efficiency of this faculty.

5. Conclusion

As is evident, there is a difference in the ranking of faculties between the two methods of traditional DEA and DEA with double frontiers and this difference is more observed in the inefficient units. For example, the Faculty of Engineering has gained rank 4 in the traditional DEA method but rank 6 in the method of DEA with double frontiers or the Faculty of Literature which has achieved rank 5 in the traditional DEA method but rank 4 in the method of DEA with double frontiers with respect to efficiency. Another major difference in the ranking between the two models of DEA is regarding the Faculty of Architecture which is identified as an efficient unit in the traditional DEA method and the most inefficient unit in the method of DEA with double frontiers. Based on the mentioned points and awareness of some of confidential information not possible to be published in this research, the following results can be obtained from the present study.

1. In the ranking of the faculties of Yazd National University, there is a difference in terms of efficiency between the two methods of traditional DEA and DEA with double frontiers.
2. The results achieved from the model of traditional DEA in this research are more reliable than those of the model of DEA with double frontiers.

6. Suggestions

Review and selection of some criteria (different from the criteria of this research) and re-execution of the models of traditional DEA and DEA with double frontiers and comparison of the obtained results

Use of the model of DEA with double frontiers for efficiency evaluation of DMUs and their ranking in other research fields

Modeling the hierarchical goal programming Data Envelopment Analysis: in order to construct this model, the faculties of Yazd University can be divided into a few sections and efficiency can be calculated at various levels using the analysis-oriented efficiency model. In this regard, designing a hierarchical profiling model, which is a combination of the two models of profile and hierarchical DEA, is a desirable innovation not attempted so far by anyone.

7. Limitations of the Research

Among the limitations in this research, the following can be noted.

In order to increase efficiency, the DEA model and the number of DMUs are selected over 3 times the sum of inputs and outputs while the present research does not follow this rule and naturally the efficiency of the model somewhat comes down.

Lack of access to some confidential information due to the confidentiality, leads to the elimination of some of the variables of decision in the current study. In this respect, the variables of the method of teacher evaluation and the intake of staff and teachers.

Generalization of the results and findings obtained from this research to similar cases needs further study and investigation.

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