Research Journal of Applied Sciences 11 (4): 116-120, 2016
ISSN: 1815-932X

Evaluation of the Performance of Educational Groups of Farhangian University, Province of Guilan, Using Data Envelopment Analysis and Prioritization Based on the AHP Model

[1]Zohreh Esmaeili and [2, 3]Seyedeh Ashraf Rezaeian
[1]Department of Educational Science and Psychology,
Payame Noor University, P.O. Box 19395-3697, Tehran, IR of Iran
[2]Payame Noor University, South Tehran, Iran
[3]Farhangian University, Rasht, Iran

Abstract: University and its collection as a non-profit organization have special mission and goals and like all other organizations for maximum utilization of their limited and resources and to reach their goals, they need to evaluate their performance. Considering the extreme importance of universities in growth and development of countries, evaluation of the performance of educational groups in universities has high importance. Therefore, correct evaluation of their efficiency and identification of weaknesses, strengths, opportunities and threats can be appropriate strategy for appropriate planning, optimal resource allocation and achieving strategic goals. Therefore, this study was performed with the purpose of evaluating the performance of educational groups of the Farhangian University, Guilan Province. This research was applied in purpose and method of data collection was documental. Statistical population of this research constituted of all educational groups at the Farhangian University, Guilan Province. With the use of data envelopment analysis sampling, 7 groups were included in the study. Data collection was performed using real information from the research center of the Farhangian University, Guilan Province. The results of the research showed that the «physics» educational group had highest priority in performance and efficiency (by both DEA and AHP Methods).

Key words: Performance evaluation, educational groups, Data Envelopment Analysis (DEA), Analytical Hierarchy Processing (AHP), accessible

INTRODUCTION

Without doubt the mission and main purpose of every collection is effective and efficient utilization of resources available. What enables organizational directors to face economic, technical and knowledge challenges is optimal use of facilities, resources and potential capacities in various sections of the organization (Amado *et al*., 2012). Clearly, achieving this important task is not possible without plenty and sufficient understanding of managers of the level of appropriateness and desirability of abilities, activities and results of their performance in today's complex and dynamic environments. The topic of efficiency of organizations is a historical and highly dominated discussion. Scientific management requires that higher organizational directors show sufficient sensitivity to overall organization efficiency and efficiency of units under its coverage. University as the most important center of provision of educational and developmental services with absorption of human, physical, monetary and credibility resources as input carries out its main mission which is increasing knowledge, creating scientific and research productions as output. If efficiency is considered as the ratio of output to input, absolute value, relative value and also processes of change need to constantly be at the top of the mind of senior directors and university planners and be their persisting mental occupation. Additionally, since the overall efficiency of an educational center results from efficiency of each and every unit it covers it is necessary that university management takes a scientific and persistent look at the situation of all units under coverage regarding efficiency and method of resource consumption in the units should be taken into consideration (Goudarzi *et al*., 2012).

Evaluation of performance of educational groups is considered as part of the difficult process of resource allocation in the university. The main issue is that with past criteria of evaluation of performance which is mainly financial and based on the accounting system, we cannot

Corresponding Author: Zohreh Esmaeili, Department of Educational Science and Psychology,
Payame Noor University, P.O. Box 19395-3697, Tehran, IR of Iran

evaluate nonprofit and public organizations, schools and universities. The reason is that firstly, their purpose is not making profit and secondly, their financial resources are procured from merchandise retail or provision of services. One of the methods that now a day is applied extensively in evaluation of performance is data envelopment analysis. DEA is a method for comparison and evaluation of relative efficiency of decision making units that have several similar inputs and outputs and also AHP Method which has the goal of creating or forming hierarchy of complexity of a problem by way of classified ranks from large to small or from general to specified and economical issues such that by better understanding of the topic increased precision is gained (Tavari *et al*., 2008). Therefore, this research with the purpose of evaluating performance of educational groups at the Farhangian University, Guilan Province was performed using DEA approach and ranking based on the AHP Model.

Theoretical principles and research background

Evaluation of performance: Experts and researchers believe that performance evaluation is the main topic in all organizational analyses and imagination of an organization that does not include evaluation and measurement of performance practically seems impossible (Grafton *et al*., 2010). Performance evaluation is: «the process of quantification of efficiency and efficacy of performance» and with a review of the topic literature, the reasons for it can be divided into three main groups. First are strategic goals which include strategic management and reevaluation of strategies. Second are communicational goals that include control of the present situation, showing future directions, provision of feedback and modeling from other organizations. Third are motivational goals that include formulation of a system of rewards and encouragement of betterment and learning. Without overall understanding of past events, educational evolution, revision and persistent change will not exist and without evaluation of performance based on key constituents and indices, revision and constant change in the path of development and promotion of university quality will not realize. The system of evaluation of appropriate performance can apply qualifications in the direction of organizational development in an appropriate way (Christine *et al*., 2006).

Models for performance evaluation: With increased competition in the area of production and services, organizations become needy of indices and models for evaluating their performance. Occurrence of such a need and lack of efficiency of measurement systems with traditional performance has led to creation of new models for performance evaluation at the organizational level. Among the most important and prevalent models of performance evaluation, we can mention deming prize, pyramid performance, Business Process Management System (BPM), Management by Objective (MBO), Total Quality Management (TQM), Malcolm Baldrige National Quality Award (MBNQA), European Foundation for Quality Management (EFQM), Balance Score Card (BSC) and Data Envelopment Analysis (DEA).

Study of existing methods for performance evaluation of educational groups at universities shows that due to lack of standard and heterogeneity of educational group activities, results from various universities are not comparable. Therefore, now a day new techniques are used for evaluation of performance where one of the most applicable of them is data envelopment analysis. Performance evaluation is the main concern of organizational directors in the difficult competitive conditions of the 21st century. Invention of performance evaluation techniques for complex behavioral conditions and variety of organizational services rendered is major part of modern research by administrative directors at the global level. DEA is among the most efficient performance analysis techniques with experimental documentation and mathematical methods.

Data Envelopment Analysis (DEA): DEA is a linear programming technique that is used for evaluation and efficiency of homogeneous and similar quality units. In the recent decade, this method has acquired significant utility as a managerial tool for measuring efficiency and has been used extensively. This tool is used in private and public sectors and organizations such as banks, hospitals, universities and etc (Mehrabian *et al*., 2011). In DEA, there is no need for determination of the function of distribution and hypothesis building. As such, DEA with construction and solving of n models evaluates the performance of n units in comparison to each other and optimizes each observation by comparison with efficient boundaries. Among various models of DEA we can mention input centered CCR, output centered CCR (Charnes Cooper Rhodes), input centered BCC (Banker Charnes Cooper), output centered BCC and group model. In Table 1, various models for DEA have been compared.

Output centered CCR: Efficiency can be evaluated by two outlooks, focus on inputs and outputs. Charnes, Cooper and Rhodes have defined efficiency considering these two outlooks as follows in an input

Table 1: Comparison of various DEA Models

Model description	Efficiency with constant scale	Efficiency with variable scale	Constant output and decreased input	Constant input and increased output	Concurrent input decrease and output increase
Input centered CCR	*		*		
Output centered CCR	*			*	
Input centered BCC		*	*		
Output centered BCC		*		*	
Total		*			*

Table 2: Input and output variables

Criterion	Sub-criterion (index)
Inputs	
Teaching experience of members	Mean teaching experience of group members from the beginning of employment
Outputs	
Compilations of the educational group	Includes number of scientific articles published in Persian and non Persian journals, number of books published including compilation and translation, number of congresses and seminars and research plans
Students grade point averages	Mean grade point average of students in the two first and second semesters in 2013-2014

centered model, a unit is inefficient if there is a possibility for decrease in each of the inputs without increase in other inputs or decrease in one of the outputs and in an output centered model, a unit is inefficient when there is a possibility for increase of one of the outputs without increase in an input or decrease in another output. A unit is efficient if and only if neither of the two mentioned cases occur. Efficiency less than one for a unit means that linear combination of other units can create the same amount of output with use of fewer inputs. Output centered model expresses this concept with increased clarity. Unit under consideration of zero is efficient when no convex combination of units is able to provide a higher output compared to the considered unit with increased resource utilization (inputs) or decreased output of other units.

CCR out put centered model:

$$\text{Min } Z_o = \sum_{i=1}^{m} V_i X_{io}$$

S.t.

$$\sum_{r=1}^{S} u_r y_{ro} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq o \quad (j = 1, 2, ..., n)$$

$$u_r, v_i \geq o$$

Analytical Hierarchal Process (AHP): The AHP Method is presented as one of the multicriteria decision making methods by professor Saati. This method gained the attention of researchers from the 1980's and up to now numerous researches have been performed on it. The purpose of AHP is creation or formation of hierarchy of complexity of a problem via classified ranks from large to small or from general to particular and economic, so with increased understanding of the topic higher precision is acquired. For performance of AHP in the first step hierarchal tree for the problem needs to b e prepared which includes the purpose, criteria and sub criteria and in the next step, a table of paired comparisons of criteria and sub criteria is prepared and presented to participants in the research. In the third step, the completed table needs to be evaluated by individuals regarding rate of incompatibility and tables with incompatibility rates of higher than 0.1 are returned to individuals for reconsideration of their judgment regarding the inadaptability. Ultimately, opinions of individuals are integrated with each other and we achieve a final ranking of the criteria (Tavari *et al*., 2008) (Fig. 1).

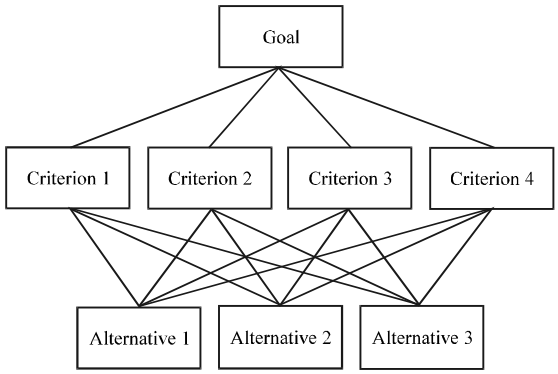

Fig. 1: Analytical Hierarchal Process (AHP) (Purpose, Criteria, Sub criteria, Choice)

Research variables: Since, the purpose of this evaluation is promotion of the performance of educational groups, output centered DEA was selected where the description of the inputs and outputs and method of their collection is as follows (Table 2).

As noted, with the purpose of prioritizing educational groups according to Table 2, three criteria

(teaching experience of members, educational group compilations and students grade point average) and their sub criteria have been considered.

MATERIALS AND METHODS

Considering that this research has evaluated the performance of educational groups of Farhangian University, Province of Guilan, using DEA and prioritizing them based on the AHP Model, purpose wise it was applied and since data collection was performed using real information, therefore, this research can be considered among documental studies. Documents used included professor's teaching experience documentation, their educational compilations and documents related to students' grade point average.

Statistical population and method of sampling: Population evaluated in this research consisted of all educational groups at the Farhangian University, Province of Guilan, where based on the DEA formula «3(number of outputs+number of inputs)≤number of units evaluated», «3(2+1)≤9» at least 9 groups need to be evaluated. In this research, due to limitation of educational groups at the Farhangian University, a number of 7 educational groups described in Table 3 participated in the study in the frame of the statistical sample.

Tools of evaluation and statistical techniques: Considering the quality of the research method, real data needed were collected via the educational unit of Farhangian University, Guilan Province. Data analysis was performed by the DEA in the DEA SOLVER Software and for prioritization of groups the EXPERT CHOICE Software was taken advantage of.

Table 3: Data related to DEA input variables

		Inputs
Rows	Educational group	Teaching experience of members
1	Math	9
2	Physics	6
3	Counseling	22
4	Developmental sciences	22
5	Arabic literature	16
6	Persian literature	17
7	Social studies	19

RESULTS AND DISCUSSION

Based on the collected data from the educational unit of the Farhangian University, Guilan Province, information regarding DEA input data for this research is described in Table 3 and output information is described in Table 4.

Based on the DEA Model and output centered CCR, input and output data were implemented in DEA SOLVER Software and results are shown in Table 5. As can be seen in Table 5, output DEA, Department of Physics efficient than other departments. It has evaluated with rank and score 1 which due to visual comparison it has been attended to in Fig. 2.

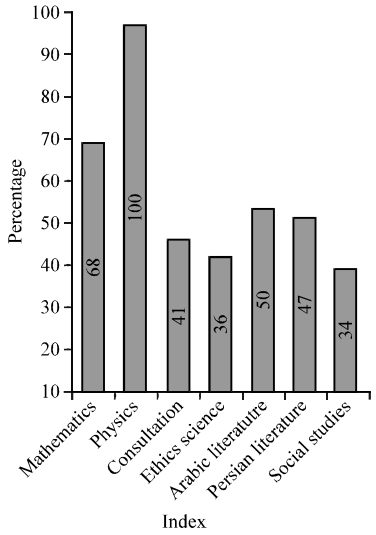

Fig. 2: Results of evaluating performance of educational groups using DEA; efficients; weak efficients

Table 4: Data related to DEA output variables

		Outputs	
Rows	Educational group	Educational group compilations	Students' grade point average
1	Math	6	15.45
2	Physics	6	15.25
3	Counseling	9	18.03
4	Developmental sciences	8	18.66
5	Arabic literature	8	17.47
6	Persian literature	8	17.96
7	Social studies	3	16.24

Table 5: Results of evaluating the performance of educational groups using DEA

Parameters	Efficiency	Mathematics	Physics	Consultation	Ethics science	Arabic literature	Persian literature	Social studies
Mathematics	67.541	67.541	100	32.244	33.371	42.959	41.566	33.629
Physics	100.000	66.667	100	40.909	36.364	50.000	47.059	15.789
Consultation	40.909	66.667	100	40.909	36.364	50.000	47.059	15.789
Ethics science	36.364	66.667	100	40.909	36.364	50.000	47.059	15.789
Arabic literature	50.000	66.667	100	40.909	36.364	50.000	47.059	15.789
Persian literature	47.059	66.667	100	40.909	36.364	50.000	47.059	15.789
Social studies	33.629	67.541	100	32.244	33.371	42.959	41.566	33.629

Table 6: Prioritization of educational groups using AHP

Rank of educational group	Title of educational group	Score
1	Physics	0.101
2	Math	0.096
3	Arabic literature	0.094
4	Persian	0.092
5	Developmental sciences	0.088
6	Social studies	0.082
7	Counseling	0.080

One of the problems with the DEA Model is that multiple decision making units are shown efficient concurrently and in this research also since the level of efficiency has been evaluated relative to other educational groups, the presented units are only considered «relatively efficient» and not definitely efficient. Therefore, for removal of this deficiency and for final prioritization of performance of the educational groups in confirmation of the results obtained, the AHP Method was taken advantage of the results of which is described. As seen in Table 6, prioritization of educational groups using AHP confirms results obtained using DEA.

CONCLUSION

Higher education in Iran during the past two decades has faced challenges and various issues. Quantitative expansion of universities, frequent variety of educational institutes, increased number of students and at times swarm of unemployed educated are among challenges that have faced Iran's higher education system with unforeseen problems. Quantitative expansion of higher education system without attention to capacities present and ability of the economic, social and cultural weave of society will also have decreased quality of the higher education system along with it.

LIMITATIONS

Limitation of production resources and facilities has been considered from old times up to today's era which is the age of ultra modern information and significant development of science and technology and in the future as well it will enforce itself with increased acuteness on economic conditions. Therefore, optimal use of facilities and resources available and promotion of efficiency and use of these resources for achievement of well fare and responsiveness to increasing needs has turned into a very important issue. One of the effective and inseparable factors is performance evaluation which makes weaknesses, strengths, threats and opportunities definite for improvement and revision of trends. Higher education centers as part of the administrative system with implementation of correct evaluation methods can tend development of specialized and efficient human resources as a model. Results of this research showed that the «physics» educational group had the highest rank in performance and efficiency (by both DEA and AHP Methods). The results obtained can be attributed to high scientific level of physics professors, who are mostly members of the university scientific community at the Guilan University and PhD students. Despite lower teaching experience compared to other educational groups, they had more scientific compilations and students in this field have high grade point averages. Evaluation of limited variables (due to use of the DEA technique) in this research is considered among the limitations of the study and expansion of them for comparison purposes and evaluation of compatibility of the results obtained is suggested for future researchers.

REFERENCES

Amado, C.A.F., S.P.S. Santo and P.M. Marques, 2012. Integrating the data envelopment analysis and the balanced scorecard approaches for enhanced performance assessment. Omega, 40: 309-403.

Christine, H., K. Robert and B. Jahn, 2006. Predicting assessment GENTER performance with 360-degree Top-down and customer based competency assessment. Hum. Resour. Manage., 45: 357-390.

Goudarzi, G., K. Sajad and A. Rouhollah, 2012. Evaluation of performance (efficiency) of selected educational groups at the Kerman University of medical sciences based on quantitative approaches. Teach. Med. Sci., 12: 193-201.

Grafton, J., A.M. Lillis and S.K. Widener, 2010. The role of performance measurement and evaluation in building organizational capabilities and performance. Account. Organiz. Soc., 35: 689-706.

Mehrabian, F., N.A. Ashkan and K.M. Somayeh, 2011. Evaluation of the level of importance of constituents identified for productivity of human resources from the view point of staff and members of scientific community of colleges of Guilan University of medical sciences. Sci. Res. J. Zanjan Univ. Med. Sci., 75: 94-106.

Tavari, M., S.M. Ali and M.S. Ali, 2008. Identification and prioritization of factors influential on productability of human resources using MADM techniques (Case study one of the Jean Wear production companies in Yazd Province). Ind. Manage. J., 1: 71-88.