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Branches Performance Evaluation System Group with the EFQM approach using DEA models

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ABSTRACT

The aim of the present study results in evaluating the performance of subsidiaries of European excellence model approach using data envelopment analysis model. Survey method is scaling and senior managers of the branches were considered as the study population. Data collected by questionnaire, which was also based on the excellence model was designed. Data collected using the European excellence model and technique DEA approach was analyzed and Based on scores in both, branches agencies were ranked. Then, using the Spearman correlation coefficient, rank correlation coefficient between the two was calculated. Correlation coefficient equal to 826.0 is calculated. The results showed that although both approaches and models of excellence and DEA results are fairly similar, but the DEA model results, has a higher accuracy and reliability.

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INTRODUCTION

Rapid changes and increasing development of organizational atmosphere inevitably need performance evaluation systems. Various models of performance evaluation systems are offered by scholars which organizations can use them according to their human source structure; so Iranian organizations are not exceptions and need patterns for evaluating organizations' performances.

Continuous attempts for achieving comprehensive patterns of evaluation and correcting traditional methods lead to presence of excellence organizational models and reception of national quality awards. Deming model, Baldrige model and European quality model are that most important models that other models are formed on this basis of them (Azar and Safari, 2004). These models evaluate organizations' performance by using comprehensive elements of quality management as under evaluation area, and by allocating predetermined indexes to each area. Aforementioned models are called self evaluated models as well. DEA is used as a mathematical method of planning for evaluating similar decision unit. Its primary hypothesis is that under consideration decision unit have similar inputs for producing similar outputs. DEA models are emerged in a comparative atmosphere on the basis of the amount of ability of each unit for conversion of input to output. Above method is used for evaluating a decision unit with each kind of variety and number of input and output. Ratio of input and output weighted value reaches to its maximum by the help of math planning model and finding efficient weight of each performance effective factor. These efficient weights are achieved in a comparative atmosphere that is created by each unit. The aim of present paper is consideration of EFQM approach's results in evaluation of organizational branch's performance by using DEA model.

First, under consideration organization is evaluated in comparison with organizational excellence model and is scored on the basis of criteria and indexes of this model, and then they are considered with those criteria and by the help of DEA model. Eventually, it is considered that whether final results of DEA and EFQM models are different in evaluation of organization's performance and whether those organizations that gained higher scores in comparison with excellence model will be identified as efficient organizations in DEA model as well?

Evaluation organization's performance:

Official usage of evaluation system referred to 19th century. It can be said that performance evaluation is developed along with development of management thinking in the format of management schools. Changes and

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developments of evaluation indexes in the formant of offering comprehensive and general principles for evaluating organizations, show procedure of evaluation systems' development (Tabarsa, 1999).

In Iran, for the first time in national level in 1970 it was appointed that governmental organizations should be evaluated from managerial and administrative aspects. To do so, center of governmental organizations' evaluation was formed in premiership, but evidences show that after 30 years there isn't any determined system for evaluation in national level (Azar and Safari, 2004).

In consideration of existence philosophy of performance evaluation, there are 2 views. One of them is traditional attitude toward evaluation, in which the most important aim is evaluation, judgment and reminder of performance.

The other is modern attitude, in which growth and improvement of performance are important factor and dynamism is the main and distinguished aspects of it.

There are lots of definitions of performance evaluation. Some define it as:

A systemic attempt for knowing that how much organization services can respond to individual needs and how much is the ability of organization for providing services (Halachemi, 1999), and some others defined it as:

Procedure of evaluation and measurement of performance in administrative systems in principled and scientific framework for achieving aims in the format of administrative programs (Hingaft, 2000).

Performance evaluation is expressed in the format of the aspect of using facilities and resources of efficiency indexes. If in the simplest definition, the ratio of data by output is known as efficiency, performance evaluation system will evaluate the amount of management decisions' efficiency for efficient use of facilities and resources.

Organizational performance evaluation usually is equivalent with the amount of activities' effectiveness. Effectiveness means the amount of achieved aims and programs which are efficient in operation (Rahimi, 2006).

Different models of performance evaluation:

Although the main aim of every performance evaluation pattern is determination of organizational efficiency and effectiveness, it should be able to define weak and strong points of organization as well and can offer solutions for eliminating possible weak points. So recognition of different patterns of performance management and correct emergence of these patterns are the aim main issues in this subject. Perhaps, by wrong selection of a specific method, a unfavorable situation will be shown favorable and vice versa.

To have better understanding, evaluation models for performance management are shown in below table:

Table 1: Patterns and models of evaluation and performance management (Shaikhzadeh, 2008)

Common patterns for evaluating organization's performance	
1- Stable framework	18- Patterns of evaluation state organizations' performances according to strategic needs
2- Beneficiants' analytical method	19- DEA model
3- Management system on the basis of aim	20- Ideal math planning model for allocating budget in state organizations
4- Deming's award model	21- Fisher's patterns for evaluating performances
5- Malkam Baldvidgo model	22- Bench Marking pattern
6- Quality award of America president	23- Re-engineering pattern
7- EFQM model	24- Ghabod theory
8- Canada excellent organizational model	25- Performance evaluation matrix
9- Australia excellent organizational model	26- Performance 3-D model
10- Weighted evaluation model	27- Procedure value model
11- Evaluation pattern	28- Sink and Total model
12- GPRA	29- Performance charter model
13- AHP	30- Results and causes model
14- TQM	31- Financial evaluation models
15- Composed pattern with sequenced decision making model	32- Quality management system
16- Determination of organization effectiveness included:	33- Performance pyramid
System resources method	34- Costumer–oriented model of strategic planning
Competitive values method	35- Others
Output aims method	
17- Determination of organization efficiency, a pattern for achieving procedure of performance evaluation.	

Regarding that suggested model of present paper is on the basis of organizational excellence model of European foundation of quality management (EFQM) and DEA, these two models are identified firefly as follow:

EFQM model:

Organizations need specific and proper tools and managerial structure in order to evaluate themselves and compare their structures with other organizations. EFQM model includes such features, this model has a criteria, among them 5 criteria are related to enabling: leadership, approach and strategies, employees,

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cooperation and resources, procedures and 4 criteria are related to results: costumers' results, employees' results, communities' results and performances' key results.

Enabling criteria cover performances of organization and are factors that enable organizations for achieving excellent results; results criteria are those results that an organization achieve and express outcome of proper execution of enablers.

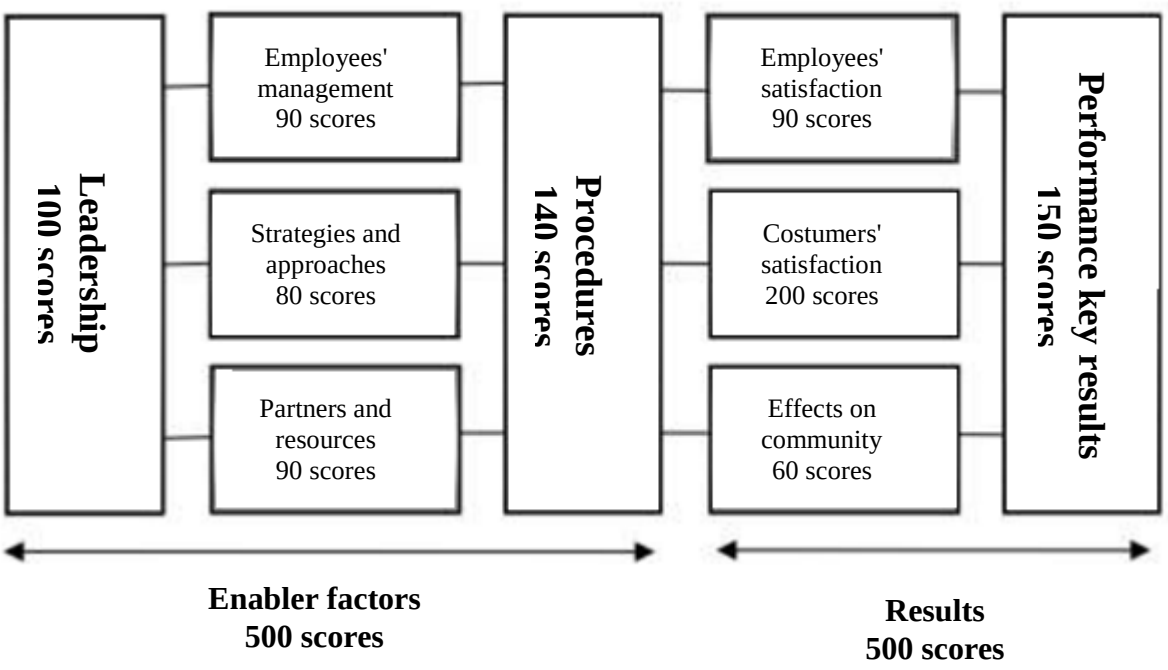

Fig. 1: EFQM model

Although there are increasing numbers of DEA models and gain specialized aspect, the base of all is main models of CCR and BCC which are designed by founders of this method (Azar and Gholam Rezaei, 2005). Of course these 2 models are 2 basis models for DEA but they aren't able to rank efficient units. Therefore, Anderson and Peterson models are also identified which are able to rank efficient units by calculating super performances.

CCR model:

The name of this model is abbreviation of its inventors' name i.e. Charls, Copper and Rodez and is considered as a basis for forming other patterns. This model has constant yield to scale and tries to increase efficiency denominator of this unit (zero unit) in a way that other units' performances don't exceed than 1; it does such work by selecting efficient weight for input and output variances of under studied unit.

$CCR'_D - I$

$$\text{MAX } w_p = \sum_{r=1}^{s} u_r y_{rp}$$

St:

$$\sum_{i=1}^{k} v_i x_{ip} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{k} v_i x_{ij} \leq 0 \qquad j = 1, \ldots, n$$

$$u_r \geq 0 \qquad r = 1, \ldots, s$$

$$v_i \geq 0 \qquad i = 1, \ldots, k$$

It this model WP is relative performance of decision unit of p. In the other word, this model seeks for founding maximum output regarding input's limitations.

X_i and y_i indicate input k and outputs for n understudied units. V and u vectors indicate input and output weights orderly. First limitation is denominator of primary aim's function, through this model can be solved in linear planning format. Second limitation ensures that, performance rank of none of the decision units will

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exceed than one. Above model should be applied for each decision units to determine relative performance of every unit (Azar *et al*., 2006).

BCC model:

This model is the result of adding convexity constraint to primary planning of CCR. It means that free variable in U_o is added to model which lead to appearance of convexity constraint or limitation $\sum_{j=1}^{n} \lambda_i = 1$ in secondary form of model. So that yield to scale can be constant, additive or subtractive (Azar *et al*., 2006).

BCC_D – I

MAX $w_p = \sum_{r=1}^{s} u_r y_{rp} + u_0$

St:

$$\sum_{i=1}^{k} v_i x_{ip} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{k} v_i x_{ij} + u_0 \leq 0 \qquad j = 1, \ldots, n$$

$$u_r \geq \varepsilon \qquad r = 1, \ldots, s$$

$$v_i \geq \varepsilon \qquad i = 1, \ldots, k$$

Free in u_o sign

Anderson – Peterson model:

This model is a ranking technique for performance units that allows "P" unit to gain more than one amount, such work will be done by omitting P^{th} limitation in primary model (Azar *et al*., 2006).

MAX $w_p = \sum_{r=1}^{s} u_r y_{rp}$

St:

$$\sum_{i=1}^{k} v_i x_{ip} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{k} v_i x_{ij} \leq 0 \qquad j = 1, \ldots, n \,\&\, j \neq p$$

$$u_r \geq 0 \qquad r = 1, \ldots, s$$

$$v_i \geq 0 \qquad i = 1, \ldots, k$$

The relation between input – output and the number of decision units:

The noticeable issue in CCR pattern is that if there isn't any significant difference between number of decision units and input, output numbers, after solving the problem, most of the decision units will be efficient.

Experiences show that the number of under studied units in comparison with total number of inputs and outputs follow the below equation (Mehrabian, 1999).

- The number of understudied decision units should be larger than triple of total input and outputs or the number of under studied units should be larger than twice of input × output. Present study obeys such rule.

Method:

As present study seeks to consider the results of EFQM and DEA models in performance evaluation of organizations, the purpose of this study is descriptive – analytic. In addition, as data are gathered from real organizational environment the entity of present study is a branch of field study.

To gather second phase of data, library method is used. Moreover, to evaluate EFQM indexes, standard questionnaire was used.

Study's variables:

In DEA model in order to determine performance of each unit, 2 types of variables were used. First category is input variables and second category is output variables. The precise description of each are presented as follow:

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Input variable:

Since EFQM model is used in present study, input variables are enabler variables in EFQM model. These variables and their definitions are shown in table 2.

Table 2: Input variables of EFQM model

variable	Definition
Leadership	To what extent leaders and executive teams' behaviors inspire and develop excellent performance culture as the best way for achieving organizations' aims
Employees' management	To what extent organization can release potential abilities of employees
Strategies and approaches	To what extent organization adjust, develop, and revise its strategies and approaches and convert them to programs and measurements
Resources and contributions	To what extent organization administrates its contribution and resources toward supporting approaches, and performing procedures effectively
Procedures	How organizations can recognize, review and improve its procedures

Output variables:

Output variables are those of results variables in EFQM model. These variable and their definitions are presented in table 3.

Table 3: Output variables of EFQM model

variable	Definition
Costumers' results	Whatever that organization gains in relation with its costumers
Costumers' results	Whatever that organization gains in relation with its employees
The results of effects on community	Whatever that organizations gain in satisfying the community's expectances
The key results of performance	Whatever that organizations can gain in relation with its planned performances

For data gathering, standard questionnaire of EFQM model was used. This questionnaire was adopted from the study of Bluesaz *et al*. (2009). Then questionnaire was sent to senior managers of "Hamkaran System" organization via email. It should be mentioned that all of the managers were familiar with principals of EFQM model, so there wasn't any specific problem for filling the questionnaire.

After completion of questionnaire, data was extracted and was saved in software to be prepared for analyzing by DEA method. It should be mentioned that in such modeling, sampling is not proper so the results can't be generalized.

The amount of inputs and outputs:

After gathering questionnaire, data was entered to Excel and the score of each variable was calculated according to coefficient of each variable in EFQM model. The results are shown in table 4.

Table 4: The achieved scores of each variable regarding questionnaire of excellent model

	Input variable					Output variable			
Branch	Leadership	Employees' management	Strategies and approaches	Partners and resources	Procedures	Employees' results	Costumers' results	Effects on community	Performance key results
1	80	68	48	58	102	50	116	36	90
2	90	76	58	61	114	63	164	40	107
3	85	61	67	61	108	77	142	28	81
4	80	72	61	58	114	59	160	40	111
5	75	65	54	58	114	50	124	40	90
6	40	58	35	51	96	50	111	56	99
7	90	65	51	54	108	68	111	16	90
8	90	76	70	61	114	72	156	44	77
9	70	61	61	48	96	54	151	44	107
10	80	68	64	61	102	63	133	44	107
11	75	68	64	61	126	63	151	56	94
12	70	65	67	61	126	72	151	44	94
13	75	61	58	64	120	77	156	52	116
14	65	72	58	54	120	68	147	52	107
15	70	54	54	70	102	54	129	56	107
16	80	58	61	70	96	59	124	56	107
17	70	61	64	70	108	68	138	52	99
18	70	65	54	64	108	63	142	52	99
19	70	68	67	51	114	63	129	40	86
20	70	68	58	51	102	63	138	40	94
21	70	68	54	61	114	63	142	44	103
22	85	61	58	61	108	63	146	31	84
23	80	58	58	67	126	59	146	41	79

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24	80	61	70	58	132	54	151	45	72
25	75	61	61	58	114	54	124	33	87
26	60	72	51	48	120	59	124	35	86
27	70	65	61	64	126	68	106	49	67
28	85	79	58	58	114	54	115	41	111
29	75	79	67	61	120	45	102	36	83
30	60	61	61	45	120	54	124	31	82

In the next step, the total score of each branch was calculated and branches were ranked according to achieved scores. The results are indicated in table 5.

Table 5: Branches' ranking according to organizational excellent model

Branch	Score on the basis of excellent model	Rank
1	647	28
2	773	2
3	710	16
4	754	5
5	670	23
6	595	30
7	653	27
8	759	3
9	692	19
10	723	10
11	759	4
12	750	6
13	778	1
14	742	7
15	697	18
16	711	15
17	729	8
18	717	12
19	688	20
20	684	21
21	720	11
22	697	17
23	713	14
24	724	9
25	668	25
26	654	26
27	676	22
28	715	13
29	668	24
30	637	29

The result of DEA model solution:

To evaluate results through DEA model, achieved data was used in the format of the amount of each element, those data that are related to 5 enabler factors were considered as input and 4 factors of results area were considered as output. The important note is that in EFQM model and any other excellent performance models, the scores of different criteria were summed up and a final score is offered, but in suggested model of this paper , cognate criteria was compared with each other. So there isn't need for emerging weight coefficient of EFQM model to achieve a final score. Before data analysis, all variables' data was converted to an amount in the range of 0-10.

It is important to pay attention that in evaluation by DEA model lower input show more efficient organization, but in EFQM the higher inputs are more valuable and show more efficient organizations (Azar *et al*., 2005). So for modeling, enabler data (inputs) was inverted then was emerged in the model.

Related data to model's inputs and outputs and inverted inputs are shown in table 6.

Table 6: Related data to model's inputs and outputs

	Input variable					Output variable			
Branch	Leadership	Employees' management	Strategies and approaches	Partners and resources	Procedures	Employees' results	Costumers' results	Effects on community	Performance key results
1	0.20	0.24	0.40	0.28	0.32	0.55	0.58	0.60	0.60
2	0.10	0.16	0.28	0.24	0.24	0.70	0.82	0.67	0.71
3	0.15	0.32	0.16	0.24	0.28	0.85	0.71	0.47	0.54
4	0.20	0.20	0.24	0.28	0.24	0.65	0.80	0.67	0.74
5	0.25	0.28	0.32	0.28	0.24	0.55	0.62	0.67	0.60
6	0.60	0.36	0.56	0.36	0.36	0.55	0.56	0.93	0.66

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7	0.10	0.28	0.36	0.32	0.28	0.75	0.56	0.27	0.60
8	0.10	0.16	0.12	0.24	0.24	0.80	0.78	0.73	0.51
9	0.30	0.32	0.24	0.40	0.36	0.60	0.76	0.73	0.71
10	0.20	0.24	0.20	0.24	0.32	0.70	0.67	0.73	0.71
11	0.25	0.24	0.20	0.24	0.16	0.70	0.76	0.93	0.63
12	0.30	0.28	0.16	0.24	0.16	0.80	0.76	0.73	0.63
13	0.25	0.32	0.28	0.20	0.20	0.85	0.78	0.87	0.77
14	0.35	0.20	0.28	0.32	0.20	0.75	0.73	0.87	0.71
15	0.30	0.40	0.32	0.12	0.32	0.60	0.64	0.93	0.71
16	0.20	0.36	0.24	0.12	0.36	0.65	0.62	0.93	0.71
17	0.30	0.32	0.20	0.12	0.28	0.75	0.69	0.87	0.66
18	0.30	0.28	0.32	0.20	0.28	0.70	0.71	0.87	0.66
19	0.30	0.24	0.16	0.36	0.24	0.70	0.64	0.67	0.57
20	0.30	0.24	0.28	0.36	0.32	0.70	0.69	0.67	0.63
21	0.30	0.24	0.32	0.24	0.24	0.70	0.71	0.73	0.69
22	0.15	0.32	0.28	0.24	0.28	0.70	0.73	0.51	0.56
23	0.20	0.36	0.28	0.16	0.16	0.65	0.73	0.69	0.53
24	0.20	0.32	0.12	0.28	0.12	0.60	0.75	0.75	0.48
25	0.25	0.32	0.24	0.28	0.24	0.60	0.62	0.55	0.58
26	0.40	0.20	0.36	0.40	0.20	0.65	0.62	0.58	0.57
27	0.30	0.28	0.24	0.20	0.16	0.75	0.53	0.82	0.45
28	0.15	0.12	0.28	0.28	0.24	0.60	0.58	0.69	0.74
29	0.25	0.12	0.16	0.24	0.20	0.50	0.51	0.60	0.55
30	0.40	0.32	0.24	0.44	0.20	0.60	0.62	0.51	0.54

By solving above problem through BCC model, efficiency of each branch was calculated. It should be mentioned that in above model, both input-oriented and output-oriented attitudes reached to same results. The results of problem solving through BCC model are shown in table 7.

Table 7: Branches' ranking on the basis of BCC model

Branch	Efficiency on the basis of BCC model	Rank
1	0.669	22
2	1.000	1
3	0.977	4
4	1.000	1
5	0.727	18
6	0.720	19
7	0.993	2
8	1.000	1
9	0.761	16
10	0.890	10
11	1.000	1
12	1.000	1
13	1.000	1
14	1.000	1
15	0.812	15
16	0.988	3
17	1.000	1
18	0.957	7
19	0.878	12
20	0.714	20
21	0.899	8
22	0.852	14
23	0.973	6
24	1.000	1
25	0.745	17
26	0.860	13
27	0.891	9
28	0.977	5
29	0.884	11
30	0.705	23

As it is observable in table 7, one of the problems of ranking via DEA ranking via DEA model is that some decision units can gain efficiency of (1) simultaneously, so branches' ranking is faced to problem. To solve such a problem notion of super performance can be helpful.

One of the basis features of efficiency is that, its amount shouldn't be more than 1.

By omitting such constraint in DEA model, notion of super efficiency appears which its amount can be more than 1.

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This new model which is appeared from omission of aforementioned constraint is called Anderson-Peterson model.

The results of super performance's calculation on the basis of Anderson-Peterson and the results of branches' ranking according to this model are shown in table 8.

Table 8: Branches' ranking on the basis of Anderson – Peterson

Branch	Efficiency on the basis of Anderson-Peterson model	Rank
1	0.669	30
2	1.389	4
3	0.977	12
4	1.051	8
5	0.727	26
6	0.720	27
7	0.993	10
8	1.783	1
9	0.761	24
10	0.890	18
11	1.037	9
12	1.169	7
13	1.228	6
14	1.247	5
15	0.812	23
16	0.988	11
17	1.667	2
18	0.957	15
19	0.878	20
20	0.714	28
21	0.899	16
22	0.852	22
23	0.973	14
24	1.424	3
25	0.745	25
26	0.860	21
27	0.891	17
28	0.977	13
29	0.884	19
30	0.705	29

To evaluate the similarities between achieved results of Anderson – Peterson model and EFQM model, summaries of results are shown in table 9.

Table 9: A comparison of branches' ranking on the basis of Anderson – Peterson and EFQM models

Branch	Rank on the basis of Anderson-Peterson model	Rank on the basis of excellent model
1	30	28
2	4	2
3	12	16
4	8	5
5	26	23
6	27	30
7	10	27
8	1	3
9	24	19
10	18	10
11	9	4
12	7	6
13	6	1
14	5	7
15	23	18
16	11	15
17	2	8
18	15	12
19	20	20
20	28	21
21	16	11
22	22	17
23	14	14
24	3	9
25	25	25
26	21	26
27	17	22
28	13	13

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29	19	24
30	29	29

By comparing results of these 2 models, relative similarities between them will be appeared. To consider it more concisely correlation coefficient between 2 ranking was calculated by Spearman correlative method. Calculated correlation coefficient was equal to 0.826 which approached relative similarity between these 2 models in 0.01 significant levels.

Discussion and Conclusion:

In present study modeling of excellent performance with DEA approach was done along with offering consideration of EFQM model.

Such modeling identifies the best weights for evaluating decision units by allocating specific and predetermined weight to each area. In the other word, in such model there isn't need for summing up inhomogeneous criteria to gain a final score, its comparison basis is comparison of criteria.

Furthermore, this technique includes a systematic approach toward organization. In the other word, in evaluation of organization's performance, whole of the organization is considered as a coherence system instead of focus on different parts and their separate scores.

The results of this study show that DEA and EFQM models have relatively similar results. Moreover, by calculating spearman correlation coefficient it is shown that the results of 2 models in ranking are highly similar. But now it should be answered that the results of which model is more real and concise. To answer this question, 2 models' supports should be considered completely.

Excellent models are experimental models and have detained view to organizations. Criteria of this model in evaluation has compensatory features, it means that reduction of a criteria can be compensated by enhancement of other criteria. This feature causes that this model hasn't have precise result and shifts away from organizations' realities. But DEA model has a strong theoretical support and has comprehensive and systematic view toward performance and its criteria haven't extreme compensatory features.

Therefore, it can be concluded that, although these two models have relatively similar results, the results of DEA model is more exact and precise.

It should be mentioned that, according to similarity between understudied elements in excellent models, it is possible that different decision units will be compared through designed model. Such issue can develop DEA application. In addition, according to confirmation of aforementioned model, grounds of test and consideration of suggested excellent performance models and other similar models are provided.

Study limitations:

1. In DEA method, the more inputs and outputs can be entered to model, calculated digit will became nearer to real digit. In this study input and output variables were gained from EFQM model and researcher couldn't be able to enter other variables.

2. The other limitation is related to convention of qualitative scales to quantitative. DEA model use quantitative and explicit data, while when questionnaires are used data are categorized among implicit and qualitative measures.

Suggestions for further researches:

Regarding increasing use of DEA and EFQM models in evaluation of organizations' performances following suggestions are offered for futher researches:

1) Using strategic tools for recognizing inputs and outputs of DEA models

2) Organizing effective environmental variable on organizations' performances and detailed measurements and emergences of them in DEA models and comparing sensitivities of results with previous results.

3) Using other evaluation methods and comparing achieved results of both models.

4) Using DEA models for calculating efficiency of productive units and comparing the results with each other.

5) Using DEA models for calculating efficiency of service units and comparing the results with each other.

6) Emerging suggested model in evaluating other productive and service organizations' performances (municipals, universities, …).

REFERENCES

Andreas, C.S., Y. Stavrinides, 2000. An internal customer service quality data envelopment analysis model for bank branches, International journal of Bank Marketing, 17(8): 780-789.

Banker, R.D., A. Charnes and W.W. Cooper, 1984. “Some models for estimating technical and scale inefficiency in data envelopment analysis”. Management Science, 30: 78-92.

Charnes, A., W.W. Cooper and E. Rhodes, 1978. "Measuring the efficiency of decision making units". European Journal of Operational Research, 2(6): 429-444.

Cooper, W.W., L.M. Seiford and K. Tone, 2000. Data Envelopment Analysis: A Comprehensive Text with Models, Applications, References and DEA Solver Software. Kluwer Academic Publishers Boston.

De Koster, M.B.M., B.M. Balk and W.T.I. Van Nus, 2009. On using DEA for benchmarking container terminal, International Journal of Operations & Production Management, 29(11).

Deni, B., 2000. Measuring the efficiency of Brazilian post office stores using data envelopment analysis. International Journal of Operations & Production Management, 24(10): 1055-1078.

Farmer, S.A., 2004. A Performance Measurement Framework for internal audit. MSc Thesis University of Central England Business School, UK

Halachmi, A., 1999. Mandated Performance Measurement: A help or a Hindrance? National Productivity review, 18(2): 59-61.

Higoft, E.L., 2000. New Organization Performance test Uncover some Surpising Relotiona Behavior. Credit Union Times, 11(3), January, West Palm Beach.

Hjalmarsson, L., S. Kumbhakerm and A. Heshmati, 1996. "DEA, DFA, and SFA: A comparison". Journal of Productivity Analysis, 7: 303-328.

Hokey, M., M. Hyesung, J. Seong-Jong, 2000. A DEA –Based balanced scorecard, International Journal of Quality & Reliability Management, 25(4).

Mester, L.J., 1996. "A study of bank efficiency taking into account risk- preferences". Journal of Banking and Finance, 20: 25-45.

Mester, L.J., 1997. "Measuring efficiency at U.S. banks: Account ing for heterogemity is important". European Journal of Operational Research, 98(2): 230-242.

Resti, A., 1997. "Evaluting the cost – efficiency of the Italian banking System: What can be learned from the joint application of parametric and non- parametric techniques". Journal of Banking & Finance, 21: 221-250.

Sufian, F., 2007. "Trend in the efficiency of Singapore's Commercial banking groups". Journal of Productivity and Performance Management, 56(2): 119-128.

Sufian, F., 2011. Benchmarking the efficiency of the Korean banking sector: a DEA approach, benchmarking an International Journal, 18(1): 107-127.

Tsolas, E.I., 2010. Assessing power stations performance using a DEA –bootstrap approach, International Journal of Energy sector Management, 4(3): 337-355.