VALIDITY EXAMINATION OF EFQM'S RESULTS BY DEA MODELS

Madjid Zerafat Angiz LANGROUDI
University Sains Malaysia (USM), Mathematical Group Penang, Malaysia

E-mail: mzarafat@yahoo.com

Gholamreza JANDAGHI[1], [2]
PhD, Associate Professor, Faculty of Management, University of Tehran, Qom Campus, Iran

E-mail: jandaghi@ut.ac.ir

Abstract: *The European Foundation Quality Management is one of the models dealing with the assessment of an organization's function using a self-assessment for measuring the concepts, some of which are more and more qualitative. Consequently, the complete understanding and the correct use of this model in an organization depend on the comprehensive recognition of that model and of the different strategies of self - assessment. The process of self – assessment on the basis of this model in an organization needs using experienced auditors. This leads to reducing the wrong privilege, obeying the criteria and sub-criteria.*

In this paper, firstly there are studied some of the weaknesses of the EFQM model, then, by using the structure of input-output governing of the model and also using the Data Envelopment Analysis, a method is offered to recognize the lack of proportion between Enablers and the results of organization, which may occur due to problems and obstacles hidden in the heart of organization.

Key words: *European Foundation Quality Management; Data Envelopment Analysis*

1. Introduction

The European Foundation for Quality Management (EFQM) was founded by the presidency of 14 major European companies in 1988. Its purpose was designed as to stimulate and assist organizations throughout Europe to participate in improvement activities leading ultimately to excellence in customers' and employees' satisfaction, to influence society and business results and to support the managers of European organizations in accelerating the process of making Total Quality Management (TQM) (Besterfield & Besterfield - Michna 1999) a decisive factor for achieving global competitive advantage.

Until 1995, almost 60% of the European organizations were using the EFQM model to assess their organization. Many papers in this area have been published, while each of them was trying to complete this model. For example, EFQM (1999b) describes the Radar

Logic which is known as the heart of the excellence model. EFQM (2000) is considering the aspects of Deployment and Assessment and Review within the Radar Logic. Lascelles and Peacock (1996) have studied the area of scoring the aspects of Deployment and Assessment and Review and their results are being considered in EFQM (2000). In 2003, a new edition of the model was presented, which in comparison with the previous edition, had considerable amendments in the sub-criteria and in the guidance points (EFQM 2003).

In contrast, Charnes, Cooper and Rhodes (1978) developed data envelopment analysis (DEA) as a methodology aimed at evaluating the relating efficiency between the decision making units (DMUs) solely on the basis of their noticed performance.

In recent years, a growing number of researchers have been looking for ways to incorporate judgment into DEA. Golany and Roll (1997) suggested an alternative approach for introducing judgment into the DEA methodology by allowing incorporation of engineering standards into the analysis. The present study uses the method proposed by Golany and Roll (1997).

This paper has been organized in five sections. The next section presents a brief review of the CCR model and structure of EFQM. The suggested methods are presented in section 3. The theoretical finding of a numerical example is solved in section 4. Finally, section 5 draws some concluding remarks.

2. Background

2.1. CCR Model

Since the seminal paper by Charnes, Cooper and Rhodes in 1978 (CCR), a variety of DEA models have appeared in the literature. Two of the DEA models that are most often associated with the DEA methodology are the CCR and BCC (Banker, Charnes and Cooper 1984) models. Let inputs x_{ij} (i=1,..., m) and outputs y_{rj} (r=1,...,s) be given for DMU$_j$ (j=1,...,n).

The linear programming statement for the (output oriented) CCR model is:

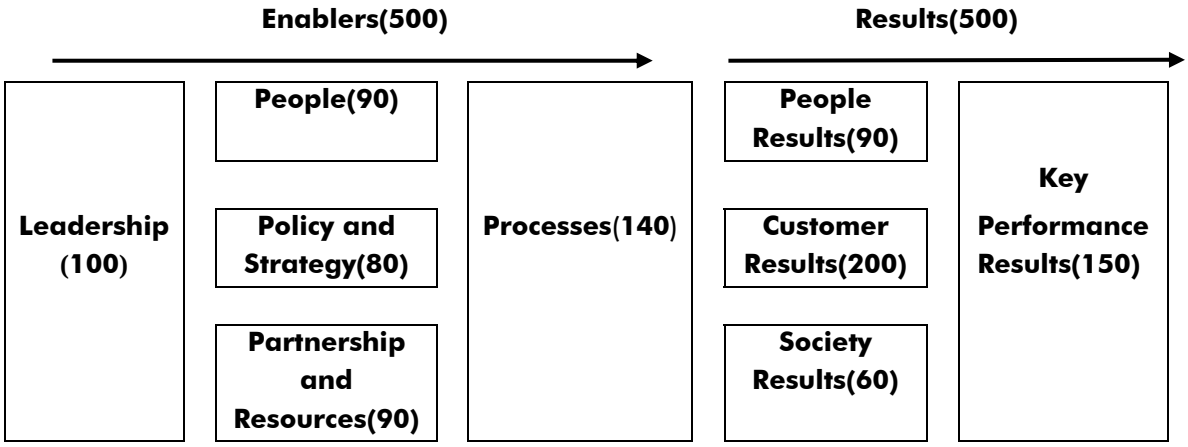
$$\begin{aligned} \min \quad & Z = \sum_{i=1}^{m} v_i x_{ip} \\ \text{s.t:} \quad & \sum_{r=1}^{s} u_r y_{rp} = 1 \\ & \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \qquad j = 1,...,n, \\ & u_r, v_i \ge \varepsilon \qquad i = 1,...,m,\ r = 1,...,s. \end{aligned} \tag{1}$$

Where, ε is a non-Archimedean infinitesimal and, x_{ip} and y_{rp} denote, respectively, the ith input and rth output values for DMU$_p$, the DMU under consideration.

2.2. EFQM

The EFQM Excellence model is a non-prescriptive framework recognizing that there are many approaches to achieving sustainable excellence. The model's framework is based on nine criteria. Five of these are "Enablers" and four are "Results". The "Enablers" criteria cover what an organization does. The "Results" criteria cover what an organization achieves.

"Results" are caused by "Enablers" and the feedback from "Results" help to improve "Enablers". The link between these criteria is illustrated below:



The model recognizes that there are many approaches to achieving sustainable excellence in all aspects of performance. It is based on the premises that excellence results with respect to Performance, Customer, People and Society, which are achieved through Leadership driving Policy and Strategy, which is delivered by People, Partnerships, Resources and Processes.

3. DEA and Errors of Assessment in EFQM

As it has been mentioned in the previous section, some of the criteria recognized in the EFQM model are qualitative, so measuring these criteria cannot be easily made. As the incorrect assessment may give an unreal image of the organization and so the organization would fall into non-existence, it deems necessary to design a control system for such situations, which may alarm and warn the organization that the assessment is not real.

Because some of the nine criteria in the model are so qualitative that their measurement needs experienced individuals and experts, there is this probability of arising errors in the self-assessment on the basis of EFQM. With regard to difficult scoring to "Enablers", probability of mistaken scoring in this area is very high. So, it seems necessary to design a system to control the accuracy of the results. With that end in view, we propose the method designed by Golany and Roll (1997) in order to standardize through DEA. For more description, we assume that the assessment criteria in the organization include one Enabler criteria and one Result criteria. We collect the results of the assessment obtained by expert assessors in the past from different organizations as to make the standard level. In figure (1), the DMUs A, B, C, D, E and F are representing such units. Efficiency frontier is represented by A, B, C and D. The gained frontier indicates that we expect to obtain the scale of "Results" in the organization by using the specified scale of "Enablers". With regard to the criteria of a qualitative EFQM, the assessment error may be more or less ignored. For example, the units E and F which are not on the efficiency frontier, but related closely to the efficiency frontier, result in acceptable evaluation. Thus, inefficient units are divided in two groups. The first group consists of inefficient DMUs or the organizations whose assessments are not acceptable and second group contains efficient units or organizations whose assessment

result is acceptable. In figure (1), the units G and H are DMUs which are scored by expert assessors. For DMU G, there are two possibilities to be taken into consideration:

1) The error has occurred in scoring.

2) There are problems in the organization, which are not being noticed by the managers.

If we accept that the assessment of the organizations A and B has been realistic, the expectation is that the organization G, with use of amount x_2 Enabler achieves amount y_2 result, whilst this organization has achieved to y_1 result. As it has already been mentioned, this could be due to an assessment error or to a problem within the organization that caused this situation. Therefore, it seems necessary to re-study the assessment, in order to find the cause and, in the case of finding an error, scores should be amended. If the second situation has happened, the cause should be studied. In order to distinguish the organizations whose assessment results are not acceptable, it is used the method proposed by Golany and Roll (1997). Organizations which have been assessed by EFQM model are considered as DMU. The five criteria of "Enablers" are Inputs and the other four results criteria are considered as Outputs. We collect the information relating to these units which were successfull or not in the past, but the scores have been awarded by expert assessors. We evaluate these units by the DEA. Some of them are situated on the efficiency frontier. These units will make the standard DMUs. After the standard units are recognized again by adding the DMUs which gave the scores in a certain period to the aforementioned units, it means that the evaluation is made again by using the CCR model? If a DMU causes an inefficient DMU standard, then the data of the organization is questionable and therefore it should be studied again. In the case of accuracy being confirmed, the relevant data should be presented as belonging to a standard organization. Otherwise, the given scores will not change the standard frontier. Again, the organization is being studied by ignoring the standard units, then calculating the ratio of two efficiencies for each organization (DMU) and finding the average of the obtained numbers. Again, we calculate the distance between each number and the average and we calculate the average of these distances; by subtracting the average from the obtained number, we will have the number which will represent the basis for accepting the results of EFQM. If the gained result of assessment of a DMU would be lower than this number, either it has not been calculated correctly or the obstacle factors which the assessment indexes fail to recognize have played their role in giving this results. Because we expect that the organization is using its leadership with certain power, policy and strategy, people, partnerships and resources and processes, each of them has been illustrated by a number, thus achieving series of related results.

4. Numerical Example

We consider the table 1 from the appendix section. The decision making units D1 until D25 in this table are the units that have been assessed in the past by experienced assessors and they were assigned scores which confirmed. Hereafter, these units should be called standard units. The columns 2 up to 10 are nine criteria relating to the areas of EFQM. In the evaluation made by the CCR model, there are seen the efficiency units in column 11. It is made the efficiency frontier of these units. Certainly, this doesn't mean that the other units have unreal scores, as the existence of some errors is more or less

acceptable. The proposed method specifies the area of such errors. The units D27 up to D35 are the organizations which have been assessed in a certain period, and the accuracy of their results must be studied. With this end in view, we compare them with the standard units. Table 2 shows the results of using the method for recognizing the organizations which have been wrongly assessed. The value 0.979 in the last row of table 2 is the average of the values in the last column. By calculating the average of the distance of each value from the last column, it is obtained the value of 0.019.The value 0.967 is the difference between 0.979 and 0.012, and it represents an accepted criteria for accuracy of data relating each DMU. As the values allocated to units 30, 31, 32 and 35 are less than the aforementioned number, the results of the assessment of these units are doubtful, and restudying of these units is recommended. For example, we consider the D31. The criteria of Enabler of this unit compared with D21 is bigger, while the results are lower. In other words, there have been obtained weaker results from greater Enabler. This means that either the assessment is unreal or there are some problems within the organization which need a specific study.

Table 2. The results of the proposed method

DMUs	Efficiencies of inefficient standard DMUs and under evaluation {1}	Efficiencies of standard DMUs and under evaluation {2}	$\frac{\{2\}}{\{1\}}$
D3	1	0.992	0.992
D13	1	0.999	0.999
D16	1	0.977	0.977
D17	1	0.988	0.988
D18	1	0.983	0.983
D19	1	0.986	0.986
D20	0.998	0.963	0.965
D21	1	0.972	0.972
D22	0.987	0.976	0.989
D23	1	0.996	0.996
D24	1	0.985	0.985
D26	1	0.989	0.989
D27	1	0.986	0.986
D28	1	0.998	0.998
D29	1	0.990	0.990
D31	0.998	0.945	0.947
D32	0.981	0.943	0.961
D33	1	0.976	0.976
D30	0.853	0.809	0.948
D34	0.887	0.869	0.980
D35	0.957	0.921	0.962
	0.012 Variance	0.979 average	

The second column shows the efficiency and the third column shows the reference units suitable to each decision making unit. In order to specify the scale of cumacy of the data results in case of each decision making unit under assessment, we compare this unit with the standard unit having at least one common reference. In the event that the figure of efficiency of this unit is at least bigger than the figure of efficiency of one of these units, the results of the assessment by EFQM model are confirmed. Otherwise, the restudying of the points in nine areas is recommended. For example, we consider the unit Q28. The units D15

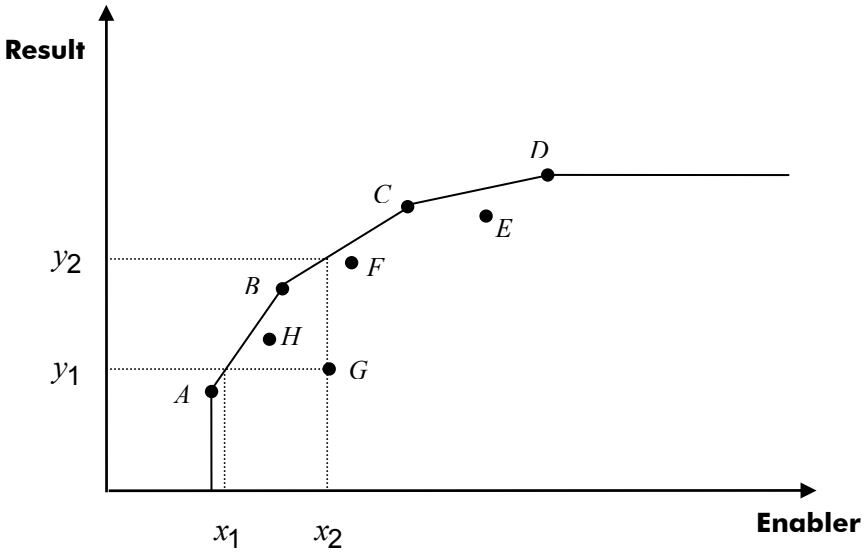


Figure 1. The efficiency of decisions

and D4 have been recognized as references for this unit. D9, D4, D11, D13, D15,D16, D17, D18, D21, D22, D23, and D24 have at least one common reference with D28 decision – making unit. The figure of the efficiency of this decision – making unit is bigger that the figure of the efficiency of unit19 (0.986) and its result is confirmed. In turn, the results obtained from point – awarding in the EFQM model for D30 demand a more precise study, as this unit, in comparison to all other reference connected decision – making standard units, has a lower figure of efficiency. The units 20, 21, 23, and 26 have at least one common reference with the decision – making unit 30. For this reason, the results of the units 31, 32, 34, and 35 need to be studied. The complete understanding and correct use of the EFQM model since its origin requires the comprehensive interpretation of this model and the different strategies of self – assessment of the organization and its proportion, as the experienced assessors need a quite qualitative approach of the current assessment criteria. Consequently, there are too many possibilities for errors to occur in the process of awarding point to the criteria and to the sub–criteria. On the other hand, it is necessary to have a coordination between the decision-makers and the awareness of their results, because this implies recognizing the failures and allowing the organization to take the appropriate measures. In this article, it is used the structure of the input-output governing EFQM model which has been taken from nine criteria and with the support of the CCR model, by using technical efficiency it is likely to detect the existence of possible errors in assessment and/or the possible non- coordination between the decision - makers and their results, items that have been studied carefully.

5. Conclusions

The complete understanding and correct use of the EFQM model in an organization required the comprehensive knowledge of this model, as the experienced assessors need a quite qualitative approach of the current assessment criteria in order to give a valuable contribution. Consequently, there are many possibilities for errors to occur in scoring the criteria and the sub-criteria. On the other hand, sometimes, it could be possible that coordination between Enablers and the results has not been made, due to some problems

within the organization, and so it needs the recognition of this failure in order to be aware of it and take the appropriate steps.. In this paper it is used the structure of the input-output governing EFQM model which has been taken from nine criteria used and with the support of the CCR model, by using technical efficiency it is more likely to detect the existence of possible errors in assessment and/or the possible non- coordination between Enablers and their results, items that have been studied carefully.

References

1. Banker, R.D., Charnes, A. and Cooper, W. W. **Some Methods for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis,** Management Science, Vol. 30, 1984, pp. 1078-1092
2. Besterfield, D.H. and Besterfield-Michna, C. **Total Quality Management, 2nd edition,** Prentice Hall, New Jersey, 1999, p. 135
3. Charnes A., Cooper, W.W. and Rhodes, E. **Measuring the efficiency of decision making units,** European Journal of Operation Research, Vol. 2, 1978, pp. 429-444
4. Golany, B. and Roll, Y. **Incorporating standard via DEA,** (in Charnes, A., Cooper, W., Lewin, A. Y. and Seiford L. M. (editors), "Data Envelopment Analysis", Kluwer Academic Publishers, Boston, 1977
5. Hakes, C. **The corporate self-assessment handbook for measuring business**, 1996
6. Lacselles, D. and Peacock, R. **Self-assessment for business xcellence,** McGraw-Hill, 1996
7. * * * **Assessing for excellence, a practice guide for self-assessment,** Brussels, EFQM, 1999a
8. * * * **Assessor Training Model,** Brussels, EFQM, 2000
9. * * * **EFQM Levels of Excellence,** European Quality Award Information Brochure for 2003,V 6 321, 2003
10. * * * **The EFQM Excellence Model,** European Foundation for Quality Management Brussels Representative Office, Belgium, 2003, p. 2

Appendix A.

Table 1. Data used in the numerical example

DMUs	Leadership	Policy& Strategy	People	Partnership& Resources	Processes	Customer Results	People Results	Society Results	k ey Performance Results
D1	50	40	44	45	70	105	44	31	74
D2	65	49	55	57	68	129	56	38	97
D3	70	53	65	67	80	141	63	40	103
D4	55	42	45	46	73	112	43	34	83
D5	60	47	52	54	75	119	52	37	92
D6	70	50	64	68	79	142	64	41	101
D7	74	53	70	73	83	150	74	43	112
D8	80	65	76	77	90	159	79	47	118
D9	75	63	72	74	80	151	75	43	114
D10	55	45	46	49	69	110	47	35	80
D11	64	49	53	54	69	127	55	39	95
D12	85	68	80	82	110	169	82	52	126
D13	80	63	77	79	95	161	79	47	121
D14	40	31	35	37	62	75	38	22	63
D15	35	24	30	33	51	71	31	22	53
D16	51	40	45	46	71	104	43	30	73
D17	65	51	56	58	69	128	55	37	96
D18	71	52	64	69	79	141	63	40	100
D19	65	49	54	55	69	126	54	38	94
D20	86	63	78	80	96	160	79	46	120
D21	36	25	31	34	51	70	30	21	53
D22	83	67	79	81	108	163	80	48	122
D23	42	31	36	37	63	74	37	22	63
D24	57	43	46	48	69	110	45	34	79
D25	75	54	73	75	83	149	77	43	113
D26	32	26	29	28	45	45	28	19	48
D27	65	49	54	55	69	126	54	38	94
D28	71	50	64	69	79	140	63	41	99
D29	65	50	52	56	73	125	52	35	90
D30	49	45	42	45	76	63	37	20	53
D31	37	25	35	39	56	70	25	21	50
D32	87	73	75	80	109	156	75	48	121
D33	51	41	46	46	70	104	42	29	74
D34	72	54	64	69	80	126	53	37	93
D35	35	27	29	30	46	44	27	20	47

[1] Gholamzreza Jandaghi Graduated from University of Toronto in Canada in 1994.
He has published as an author and co-author over 50 articles in journals and more than 30 articles on national and international conferences. He is also author of 3 books(Descriptive Statistics for Human Sciences, Probability and Statistics for Engineers and Applied Probability and Statistics for Management and Ecomics).
He teaches Mathematcs and Statistics courses and supervises master and Ph.D. students at Qom Campus of University of Tehran.
His current research areas are EFQM , Statistics Education and Simulations.

[2] Corresponding author.