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Validity Examination of EFQM's Results by DEA Models

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ABSTRACT

The European Foundation Quality Management is one of the models which deal with the assessment of function of an organization using a self-assessment for measuring the concepts some of which are more and more qualitative. Consequently, complete understanding and correct usage of this model in an organization depend on the comprehensive recognition of that model and different strategies of self-assessment. The process of self-assessment on the basis of this model in an organization needs to use the experienced auditors. This leads to reduce the wrong privilege making to the criteria and to subcriteria probable way.

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

Keywords: European Foundation Quality Management; Data Envelopment Analysis.
JEL classification: C02; L25.
2000MSC: 62C99; 90B50.

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Examen de la validez de los resultados de EFQM mediante modelos DEA

RESUMEN

La Fundación Europea de Gestión de la Calidad (EFQM) significa uno de los modelos para la evaluación de las funciones de las organizaciones, utilizando la autoevaluación para medir aspectos que, algunos de los cuales, son cada vez más cualitativos. Consecuentemente, la comprensión completa y el uso correcto de este modelo en una organización depende del conocimiento profundo del modelo y de las diferentes estrategias de autoevaluación. El proceso de autoevaluación en la base de este modelo, en cualquier organización, necesita la intervención de auditores experimentados. Esto es precisamente lo que lleva a reducir el uso incorrecto de los criterios y de los subcriterios.

En este artículo, primero se estudian algunas de las debilidades del modelo EFQM y después, mediante la utilización de estructura de control de entradas y salidas y el uso del Análisis Envolvente de Datos, se ofrece un método para reconocer la falta de proporción entre *Enablers* (consultores del potencial empresarial) y los resultados de la organización, lo que puede ocurrir debido a problemas y obstáculos escondidos en el corazón de la propia organización.

Palabras clave: Fundación Europea de Gestión de la Calidad (EFQM); Análisis Envolvente de Datos (DEA).
Clasificación JEL: C02; L25.
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1 Introduction

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

Until 1995, almost 60% of European organizations used the EFQM model to assess their organization. Many papers in this area have been published and each of them tried to complete this model. For example, EFQM (1999) describes the Radar Logic which is known as the heart of the excellence model. EFQM (2000) considers the aspects of Deployment and Assessment and Review within the Radar Logic. Lascelles and Peacock (1996) studied how to score the aspects of Deployment and Assessment and Review, the results of which are considered in EFQM (2000). In 2003, new edition of the model was presented which, in comparison with previous edition, had considerable amendments in sub criteria and in the guidance points (EFQM, 2003a).

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

In recent years, a growing number of researchers have looked into ways to incorporate judgment into DEA. Golany and Roll (1997) suggested an alternative approach for introducing judgment into the DEA methodology by allowing an incorporation of engineering standards into the analyzing. 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 on 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. Based on our knowledge, there is not any similar study with this approach; therefore, we have not presented such studies in the literature review.

2 Back ground

2.1 CCR Model

Since the seminal paper by Charnes, Cooper and Rhodes in 1978, 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:

$$\min \quad Z = \sum_{i=1}^{m} v_i x_{ip} \qquad (1)$$

$$\text{s.t}: \quad \sum_{r=1}^{s} u_r y_{rp} = 1$$

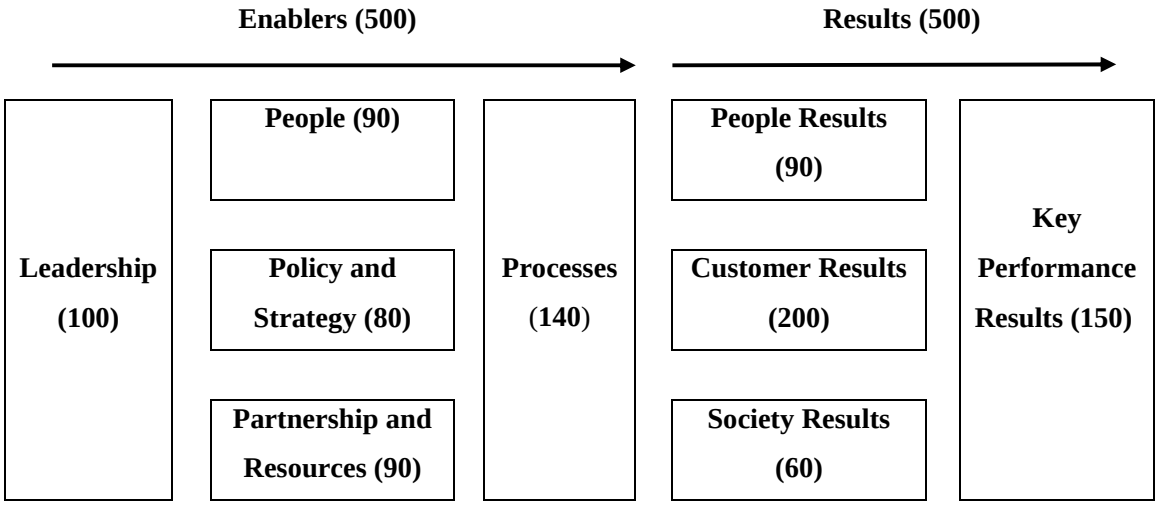
$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \qquad j = 1,..., n,$$

$$u_r, v_i \ge \varepsilon \qquad i = 1,..., m,\ r = 1,..., s.$$

Where, ε are a non-Archimedean infinitesimal and, x_{ip} and y_{rp} denote, respectively, the i^{th} input and r^{th} output values for DMU$_p$; the DMU under consideration and u and v are some coefficients (weights) which are not of interest in Golany method.

2.2 EFQM

The EFQM Excellence model (EFQM, 2003b) is a non-prescriptive framework that recognizes 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. "Results" criteria cover what an organization achieves. "Results" are caused by "Enablers", and feedback from "Results" helps to improve "Enablers". The linkage between these criteria is illustrated in the next page:



The numbers in the parentheses are the points assigned to the nine criteria of the model which shows the extent of achievement of the aims. For example, the number 100 shows the maximum points in leadership of the organization.

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

2.3 Critics on EFQM

A reason of not using mathematical models in designing EFQM is their tendency in simplification. But this may cause some irrecoverable damages to performance appraisal. In fact, we can claim that we have done a true performance appraisal, if we make use of comprehensive methods and models. That an EFQM model possesses all the characteristics of the complete model has a negative answer. In the following, we list some disadvantages of this model:

I. EFQM is an additive model in which the interaction effects of variables and indices cannot be assessed. These interaction effects are known as synergic effects which may be more than the total of individual effects.

II. There is a trade off between the model's criteria that results in covering the weakness of a criterion by the strength of another. Since the purpose of an assessment in this model

is the evaluation of the realization of model's concepts, the rate of this trade off must be determined. For example, in the process of getting promotions, the satisfaction of customers cannot be sacrificed.

III. Since achieving a maximum of 1,000 points in the nine criteria is the purpose of EFQM, no realistic promotion strategy is in the hand of decision maker. In other words, there is often a big gap between the evaluated unit and the standards of the ideal unit so that no useful information toward improvement can be gained from the evaluation.

IV. Because of qualitativeness of criteria and sub criteria, there is a high probability of wrong evaluations.

3 DEA and Errors of Assessment in EFQM

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

Because some of nine criteria in the model are so qualitative that the measurement needs the experienced individuals and experts, there is probability of arising errors in the self-assessment on the basis of EFQM.

With regard to difficult scoring to "Enablers", probability of mistake scoring in this area is very high. So, it seems necessary to design a system to control the accuracy of the results. To this end, we propose the method which Golany and Roll (1997) have designed to standardize through DEA. For more description, we assume that the assessment criteria in organization include one Enabler criteria and one Result criteria. We collect the results of assessment which obtained by expert assessors in the past from different organizations to make standard level. In Figure 1, the DMUs A, B, C, D, E and F are such units. Efficiency frontier is making by A, B, C and D. Gained frontier indicates that we expect to obtain scale of "Results" in organization by using the specified scale of "Enablers". With regard to the criteria of EFQM being qualitative, assessment error may be ignored, more or less. For example, the units E and F which are not on the efficiency frontier, but with regard to closeness to efficiency frontier, result in acceptable evaluation. Thus, inefficient units are divided in two groups. First group consists of inefficient DMUs or organizations whose assessments are not acceptable, and second group contains efficient

units or organizations whose assessment results are acceptable. In Figure 1, the units G and H are DMUs which are scored by expert assessors. For DMU G two possibilities are under consideration:

1) The error has occurred in scoring.
2) There are problems in organization, which are not observed by managers.

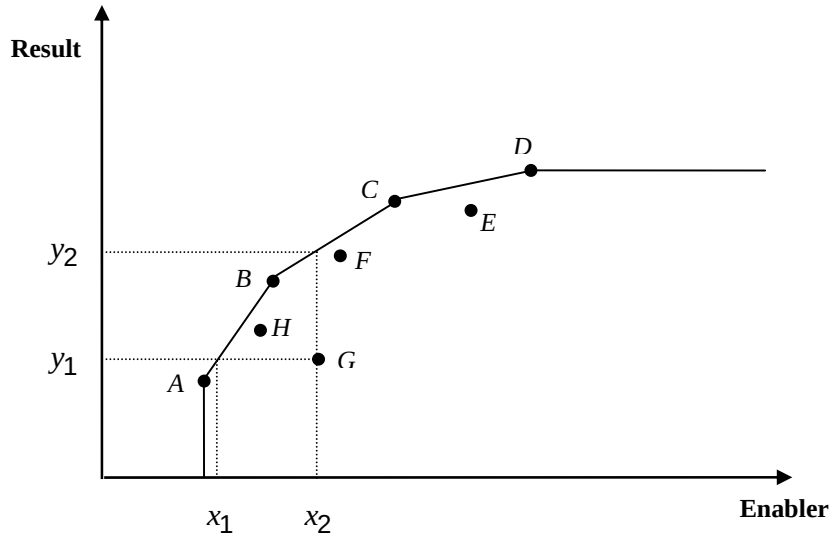


Figure 1

If we accept that assessment of organization A and B has been realistic, the expectation is that organization G with use of amount x_2 Enabler achieves amount y_2 Result, while this organization has achieved to y_1 Result. As mentioned, this could be due to assessment error or a problem within organization has caused this situation. Therefore, it seems necessary to restudy the assessment in order to find the cause and in the case of occurring error, scores should be amended. If the second situation was happened, the cause should be studied. In order to distinguish the organizations which their assessment results are not acceptable, the proposed method by Golany and Roll (1997) is used.

Organizations which have been assessed by EFQM model are considered as DMU. The five criteria of “Enablers” are Inputs and other four results criteria are considered as Outputs.

We collect the information relating to these units which were success or not in the past but were given the scores by expert assessors. We evaluate these units by DEA. Some of them place on the efficiency frontier. These units will make the standard DMUs.
After the standard units are recognized, again with adding DMUs which have been given the scores in a certain period to the aforementioned units, once more the evaluation being done by CCR model? If a DMU causes that a standard DMU is inefficient, then the data of the organization is in question and therefore it should be studied again. In the case of confirmation, the accuracy of the relevant data should be presented as a standard organization. Otherwise, the given scores will not change the standard frontier.

Once more the organization is being studied by ignoring the standard units and then calculating the ratio of two efficiencies for each organization (DMU) and gaining the average of the obtained numbers. Again, we calculate the distance of each number from average and calculate the average of these distances, with subtraction of average from the gained number; we will have the number which will be the base for accepting the results of EFQM. If the gained result of assessment of a DMU be lesser than this number, either it has not been calculated correctly or the obstacle factors which are not able to be recognized by assessment indexes have played the role to make this results.

Because we expect that the organization is using leadership with certain power, policy and strategy, people, partnerships and resources and processes, each has been shown by a number, and achieve to series of results close together. The flow chart of the methods is shown in Figure 2 (next page).

4 Numerical Examples

Now we consider Table 1. The decision making units D1 until D25 in this table are the units that have been assessed by the experienced assessors in the past and allocated scores to them are confirmed. Hereafter, these units should be called standard units. The columns 2 up to 10 are nine criteria relating to the areas of EFQM. Certainly, this does not mean that the other units have the unreal scores, because the existence of some errors may be accepted less and more. The proposed method specifies the land of these 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. To this end, we compare them with standard units.

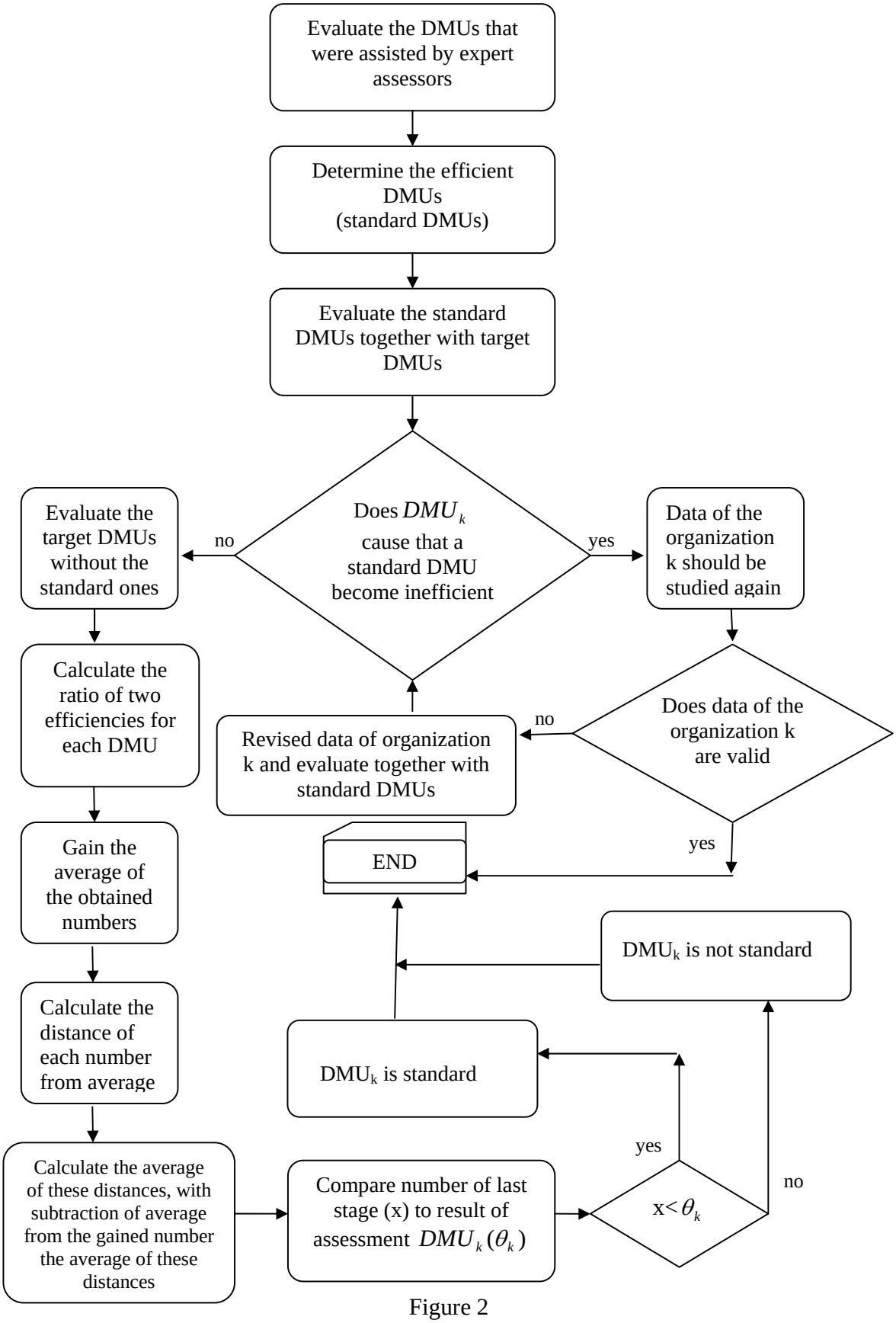

Evaluate the DMUs that were assisted by expert assessors
Determine the efficient DMUs (standard DMUs)
Evaluate the standard DMUs together with target DMUs
Does DMU_k cause that a standard DMU become inefficient
no
yes
Evaluate the target DMUs without the standard ones
Data of the organization k should be studied again
Calculate the ratio of two efficiencies for each DMU
Does data of the organization k are valid
no
Revised data of organization k and evaluate together with standard DMUs
yes
END
Gain the average of the obtained numbers
DMU_k is not standard
Calculate the distance of each number from average
DMU_k is standard
yes
Calculate the average of these distances, with subtraction of average from the gained number the average of these distances
Compare number of last stage (x) to result of assessment $DMU_k(\theta_k)$
$x < \theta_k$
no

Figure 2

Table 1. Data used in the numerical example

DMUs	Leadership	Policy & Strategy	People	Partnership & Resources	Processes	Customer Results	People Results	Society Results	Key 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

Table 2 shows the results from using the method for recognizing the organizations which have been assessed unreal. The amount 0.979 in the last row of Table 2 is the average of the amounts of last column. By calculating the average of distance of each amount in the last column, the amount of 0.019 is obtained. The amount of 0.967 is the difference between 0.979 and 0.012, which the accepted criteria for accuracy of data relating each DMU. As the allocated amount to units 30, 31, 32 and 35 is lesser than aforementioned number, so the results of assessment 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 are more; in turn the results are lesser. In other words, it has been obtained the weaker results from greater Enabler. And this means either the assessment is unreal or some problems are within organization which hair–splitting study is needed.

Table 2. The results of 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	

Second column shows the efficiency and third column shows the reference units suitable to each decision making unit. To specify the scale of accuracy of the results of data for each decision making unit under assessment, we compare this unit with the standard units which have at least one common reference. In the event that the figure of efficiency of this unit at least is greater then the figure of efficiency of one of these units, the results from the assessment by EFQM model are confirmed. Otherwise, restudying of the points in nine areas is recommended. For example, we consider the unit Q28. The units D15 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 greater that the figure of the efficiency of unit 19 (0.986) and its result are confirmed. In turn, the results from point-giving in EFQM model for D30 meet for a more precise study as this unit in comparison with all decision making standard units which have a common reference with it, has a lesser figure of the efficiency. The units 20, 21, 23, and 26 have at least one common reference with decision making unit 30. For this reason, the results of the units 31, 32, 34, and 35 need to be studied.

5 Conclusions

Complete understanding and correct using of the EFQM model in an origination required the comprehensive familiar of this model and the different strategies of self-assessment of organization and proportion; due to being qualitative more than enough of current assessment criteria's, the experienced assessors are very reporting. Consequently, there are too many possibilities to occur errors in point-giving to the criteria and to the sub criteria. On the other hand, sometimes, there should be possible that coordination between enablers and the results has been made due to same problems within the organization which recognizing of this failure allows the organization to be aware of problem inside it. In this article the structure of input-output governing EFQM model, which has been taken from nine criteria, is used and, with the help of CCR model, technical efficiency concept, the existence of probable errors in assessment and or possible non-coordination between enablers and their result, have been studied carefully.

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