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Performance Evaluation through Data Envelopment Analysis Technique and Balanced Scorecards Approach and its Application in Bank

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Abstract

In this article, an analytical model for organization performance evaluation has been presented, but there is a difference that indexes election associated with Balanced Scorecards powerful method.

Our aim to this article is comprising DEA (Data Envelopment Analysis) and BSC (Balanced Scorecards) Methods to acquire most precise & secure evaluation of organization without any personal interference and also, Performance Evaluation implementation through a comprising method which carries the entire path on to the main target in Phasing algorithm mode.

In this method, we verify and confirm index election through Balanced Scorecards following with benchmarking in forth-wise perspectives then will convert them into in-out to DEA model. So, assuring about mathematical model to evaluation of DEA, the Performance evaluation will be easily implementable.

To show this subject, a practical case study in performance evaluation in Commercial Iranian bank utilizing comprised method will be presented.

Keywords: Data Envelopment Analysis (DEA), Balanced Scorecards (BSC), Efficiency

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1- Introduction

In this article, an analytical model for organization performance evaluation has been presented in which DEA & BSC methods has been utilized.

One of the most important problems in proper Performance Evaluation is Organization performance evaluation considering its strategy & targets. If evaluation would not be performing as per the organization strategy and targets, its accuracy will be under question. Evaluation of a non profitable society considering its revenue, would be great mistake and also , evaluation of a commercial bank in financial vision, would be a uni-direct evaluation and wrong and surely will not present precise information for decision making.

BSC is managerial tool including some criteria and evaluation, and arranged as set of cards [5]. These criteria will be included of all organization aspects , related to 4 important managerial approach, and its aiming to assist top management enable them to obtain a widespread vision to their position and organization. The related cards to the balanced scorecards of performance will describe Financial structure, Marketing Application, Internal strategic measurements and Manpower role of organization. BSC method comprising financial & application scale and emphasize on their short – long terms application through organization. When realization of this approach, there is no financial & traditional vision affected to establish a perfect & useful approach of organization performance or efficiency so, BSC method will be under consideration [1].

One of the particular BSC model, has been suggested for the first time by Stewart for utilizing in projects. DEA is a mathematical technique due to calculating of rational efficiency in decision makers units based on observed in-output which present in different type and sizes [7, 8]. Due to Organization Performance evaluation, DEA technique is a powerful and notable method. In addition if index algorithm would not confirm the elected indexes, the evaluation wholly face problem [3]. On the other hand, BSC technique, has specified and secured step to index election within distinct perspectives related to organization strategy in which through comprising these two methods, it would be able to cover probable defects in indexes election of DEA (which may oppose to organization strategy with personal interference). Actually, through adding the BSC steps to the performance evaluation by DEA, it would be say that all process of Performance Evaluation has been implemented through DEA where frame work and algorithm were utilized. In second session, we review summary of DEA & BSC and in 3rd session new comprising model of BSC & DEA will present. At the end, in 4th session, a practical case in Iranian banks will be described.

2- Literature review

In recent decade, there is a tendency to performance evaluation, understanding the strength & weakness points of organization to objective conduct it to the direction of provided strategy is one of the most important parameter in macro management. Nowadays, there are many methods & techniques in this field but

electing of most effective & secured ones, is very important & difficult. The methods such as DEA which have effective performance in this field, could be ranked within the worth one which perform the evaluation. Meanwhile, BSC method is not only a strong managerial new tool to conduct the organization but also, very powerful. Here in under we summarized the mentioned methods.

2-1- Data Envelopment Analysis:

This method has been established in 1987 by Charnes et al, [3] which later modified to one of the scientific managerial methods in Performance evaluation [3]. CCR model introduced by Charnes et al and many years later bankers et al developed the BCC model which both of them were as basic models of DEA. This method applied to rational evaluation of the decision maker units utilizing mathematical programming.

The word rational, applied, since efficiency resulting from comparing the units to each other. One of the advantages of this method would be determining the production function by DEA. (The production function is a function which yield maximum values to outputs against each compound of inputs) By means of this function it could be able to judge how a DMU is working. Major model of DEA verify rational efficiency of a DMU which in fact they are ratio of scaled outputs to the scaled inputs. Actually rational effects which affected by each DMU, show its efficiency on the border. In the DEA model we encounter the problem of scale control. One of the general solutions to scale control is the Cone Ratio method. It means that, value of input – output scales would be limited to the closed Cones.

2-2 Balanced Scorecards (BSC):

BSC Method first time suggested by Kaplan & Norton [4] as a methodology in interior & exterior problem solving and also its improvement. Also BSC would be as a mean for balancing an organization with strategy and considering its targets and major criteria, which provide & identify the organization strategy and target for organization subunits from up-downward scheme [5].

Traditional Function Evaluation system, mainly are based upon financial scale which overweight the company‘s short term Profit – deficit and significance effective parameter to company profit, however respectively decreasing all major parameter regarding to expenses such as employee training plans and R&D activities suspension may increase the company’s profit [1], but will cause company to lose its competitive situation in the market & endanger it’s long term profit. Therefore in order to perform a thorough evaluation of organization Performance, it must be evaluated in 4 perspectives as follows which is one of the aims of comprising method discussed in this session [6].

1- Financial Vision
2- Customer Vision
3- Internal Process Vision
4- Learning & Growth Vision

In fact BSC method shows, how Learning & Growth of employee conclude to modification of internal processes & well rectification of them. Consequently, it will cause to establish and improve particular value to the customer & market;

finally will conduct to increasing the company's portfolio or its financial improvement.

3- BSC & DEA comprising method.

Our first duty in development of DEA based model, is selecting of most proper formula considering nature of Organization and problem involved. For instance, within an organization evaluation with different DMU and resources which their similar resources are competitive, the worth model is return to variable scale that developed by Bankers et al and known as BCC. Meanwhile CCR Model which developed by Charnes et al, is included in DEA basic models. Our main model within Performance evaluation implementation is BCC model. Our aim of application of BSC model within Performance evaluation through DEA would be association with organization strategy. In selection stage, where the main bases in index selection will specified for Performance evaluation, BSC could be effective in clearing of viewpoints, strategy and proper criteria to considering of DMU(s). Selection of Indexes, criteria & measurements are usually modernized in this case and express what is expected from organization subunits. The most important stage in Performance evaluation implementation is described as following:

1- Indexes election
2- Model Designation
3- Implementation

In first & second stage our proposed method would be affected, and implementation stage consequently is including a through & safe Performance evaluation will be terminated. As mentioned previously, within the election stage the index main basis for Performance evaluation will be specified. In this stage, BSC could assist to clear viewpoints and organization strategy in criteria and proper index election and prove their accuracy. So, we initiate with balanced scorecard to establish an evaluation through DEA including following steps:

1- Strategic Alignments:

The Accurate understanding of organization strategy would be one of the most important stages in Performance evaluation. We always initiate through this question that, what's your strategy? When the strategy has realized it would be able to erect a framework for strategy characterization, so called Strategy map. In fact, here in to, accurate realization of organization strategy has been found and it could be draw an organization strategy map.

2- Strategic Area:

Before we initiate to design balanced scorecards, one border to strategic area is required. This border limited the organization to area selected due to reach to the successful strategic. The organization might be able to perform a lot jobs, but to reach to the successful the organization obligation would be ordered in strategic direction. Indeed other organization activities which are not in strategic direction shouldn't be considered within the Performance evaluation. In most of the organization, the value of investment is considered as a strategic area. In addition, each strategic area would be flow in direction to the 4 mentioned perspectives of

BSC. It would be noted that lower layer of perspective should activate the upper layer.

3- Strategic Grids:

Now we have one strategy (First Step), and specified the strategy area (2nd Step), so, we transfer our strategy specification to one set of grids. As it was cleared & we noted again, BSC is included of 4 perspectives. Strategic Grids establishment will be started with targets and upper strategic area. We circulate our strategic area in 4 perspectives. It would be assured there is a correlation between them. This coordination would be considered as foundation of BSC model. Finally, after following this procedure for all perspectives from up to down, we could arrange our cards and correlate to each other. For instance, as mentioned before, if the investment considered as a strategic area, we could arrange each perspective as follows:

Table 1: BSC Perspective

Financial	Shareholder Value		
	Grow Revenues		
Customer	Acquire More Customers		
	Become the Price Leader		
Internal Processes	Improve Operational Efficiency		
	Cost Reduction Program	Knowledge Based System	Reduce Non Core Activities
Learning and Growth	Training - Best practices in cost management	Database network on operational performance	Re-align organization with core competencies

In brief, up to this step, following items would be thoroughly performed:

1- Strategy Knowing (understanding) (issues & targets)
2- Strategy correlation.
3- Organization directing around mentioned strategy.
4- Strategic areas restriction (less than 5 areas)
5- Correlate & connect the strategic issues into the coordination system in parallel with perspectives.

Now, we have a set of balanced scorecards in hand, which are acceptably included of secured index in related to the strategy. As noted, index election has been done in particular precision & accurate mode, which is included within BSC, so that containing all organization aspects and its strategy.

In fact, for each index within perspective, we specify it's in – out nature, so we are able to utilize DEA to Performance evaluation. It means that, through benchmarking of BSC powerful algorithm, we will acquire indexes in full complying with strategy so, the next step of BSC modeling will be use to problem solving of Performance evaluation.

As mentioned before, the BCC model applied in this article that, since lack of information in field of community return to scale, it has known as best model in problem solving which detailed here in below.

(1)

$$
\begin{aligned}
&BCC\\
&Max \quad \phi + \varepsilon(1s^- + 1s^+)\\
&\text{S.t.} \quad \sum_{j=1}^{n} \lambda_j X_j + s^- = X_k\\
&\qquad \sum_{j=1}^{n} \lambda_j Y_j - s^+ = \phi Y_k\\
&\qquad \sum_{j=1}^{n} \lambda_j = 1\\
&\qquad \lambda_j \geq 0 \ , \ s^- \geq 0 \ , \ s^+ \geq 0
\end{aligned}
$$

Of course, our BCC model will be as follows (after index scaling):

(2)

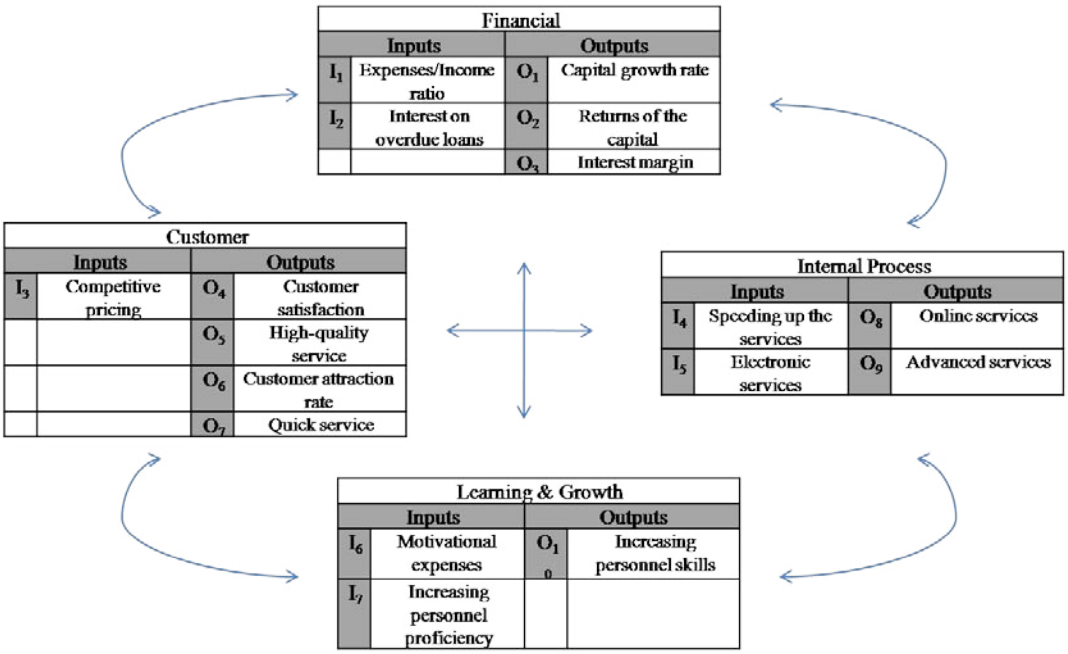
$$
\begin{aligned}
&RW - BCC\\
&Max \quad U^T Y_k + u_0\\
&S.t. \quad U^T Y_j - V^T X_j + u_0 \leq 0 \ , \ j = 1,...,n\\
&\qquad V^T X_P = 1\\
&\qquad AU \leq 0\\
&\qquad BV \leq 0\\
&\qquad U \geq 1\varepsilon \ , \ V \geq 1\varepsilon
\end{aligned}
$$

Now, the resulting index from BSC method through BCC model of Data Envelopment Analysis, we could acquire an accurate performance evaluation in organization.

4- Operating Model

To implement this model, we evaluated Iranian Banks and resulting data has been gathered from 6 Iranian Commercial Banks and at the end the following indexes have been resulted utilizing Balanced Scorecards.

Figure 1: DEA-BSC Indices



Collected Data considering BSC algorithm within 6 banks are as follows which is listed based on the cards for each DMU. Finally, through programming of BCC model (with scale controlling), within GAMS software and solving following results were obtained:

Table 2: DEA-BSC Data in Financial Perspective

	Financial				
	I_1	I_2	O_1	O_2	O_3
DMU1	%52.84	%2.68	%17.42	%4.81	%1.48
DMU2	%42.77	%9.50	%12.98	%7.16	%2.62
DMU3	%60.00	%15.00	%47.59	%7.00	%8.00
DMU4	%60.20	%8.50	%18.90	%1.40	%2.70
DMU5	%57.90	%7.30	%20.13	%1.23	%3.00
DMU6	%96.00	%14.00	%10.29	%10.20	%4.00

Table 3: DEA-BSC Data in Customer Perspective

	Customer				
	I_3	O_4	O_5	O_6	O_7
DMU1	%15.70	%3.25	%3.19	%22.91	%3.13
DMU2	%18.90	%3.21	%3.61	%25.80	%3.41
DMU3	%34.00	%3.41	%3.34	%29.00	%3.25
DMU4	%33.50	%3.12	%3.41	%34.50	%3.32
DMU5	%30.40	%3.43	%3.39	%21.80	%3.25
DMU6	%12.00	%3.74	%3.50	%13.00	%3.37

Table 4: DEA-BSC Data in Internal Process Perspective

	Internal Process			
	I_4	I_5	O_8	O_6
DMU1	800	1305	1376	91
DMU2	692	1906	1896	57
DMU3	718	1758	1842	58
DMU4	682	1500	1315	37
DMU5	643	745	787	34
DMU6	555	517	510	10

Table 5: DEA-BSC Data in Learning and Growth Perspective

	Learning and Growth		
	I_6	I_7	O_{10}
DMU1	%23.03	12.11	58.54
DMU2	%18.72	11.96	30.80
DMU3	%18.50	12.08	46.25
DMU4	%5.30	12.07	18.55
DMU5	%17.00	11.96	39.10
DMU6	%30.00	13.66	69.00

Through these results, efficiency of each bank calculated considering balanced scorecards within implementation of DEA and mentioned here in under:

Table 6: DEA-BSC Result

DMUs	EFFICENCY			
	Financial	Customer	Internal Process	Learning & Growth
DMU1	100%	65%	71%	93%
DMU2	95%	65%	100%	100%
DMU3	100%	46%	98%	73%
DMU4	49%	35%	89%	100%
DMU5	100%	67%	59%	75%
DMU6	48%	100%	55%	75%

5 – Conclusion

Presented article describes comprising method utilizing two models of DEA & BSC for Organization Performance Evaluation, in which, the BSC technique has been applied through 1st stage up to index election and ultimately, DEA good practice, implemented for performance evaluation.

In this new method, probable defects of DEA in Index election has been prevented, and this important duty undertaken by BSC. In fact, index election, considering overall criteria in Organization Performance through BSC, will give confidence rationally to the experts & managers with results of evaluation.

Meanwhile, due to performance evaluation within BSC technique which is same to advanced strategic management, the DEA technique also has been associated.

Finally, implementing of actual model: caused to obtain acceptable results and make surprisingly decision, prevent of traditional evaluation (which were only based on financial index; with financial nature) and through BSC technique, the index containing short terms cost (but were in direct with strategy improvement like R&D & Personnel Training) considered as output and their long terms effects noted rather than their costs.

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