EVALUATING THE EFFICIENCY OF BANKING INDUSTRY BY DEA: BALANCED APPROACH

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ABSTRACT

Using evaluation systems officially goes back to 19th century. What is very important to the organizations in current situation and in a competitive and changeable environment is performance improvement. Most of the Iranian Banks still use financial indicators to evaluate their performance. Financial aspects are past-based indicators and the only traditional performance evaluation measures. On the other hand, Balanced Scorecard (BSC) is a management tool which helps managers to examine their activities from different views. BSC contains of four perspectives including financial, customer, internal processes, and learning and growth perspectives and tries to make a balance between financial goals and the other remained perspectives. In this research balanced scorecard has been used to select the indicators and then by using CCR model Saderat Bank branches in Guilan province have been evaluated and ranked. The application of CCR model in sample of 29 branches identified 8 (40%) branches inefficient in 2010.

Keywords: Data Envelopment Analysis (DEA), Balanced Scorecard (BSC), Banking industry, Performance evaluation, Relative efficiency

INTRODUCTION

Using evaluation systems officially goes back to 19th century. It can be said that performance evaluation has developed by management thoughts evolution (Tabarsa, 1999). Development and change in evaluation indicators shows the evaluation systems development evolution in order to provide general and worldwide principles .What is very important to the organizations in current situation and in a competitive and changeable environment is performance improvement. Using variety of performance measurement tools e.g. EFQM, 6δ, etc. (Niknazar, 2008) firms can evaluate the efficiency and effectiveness of their business process on the way to their strategic objectives. Furthermore, performance measurement tools can help businesses evaluating their resource allocation processes in order to determine how to manage their resources better and how to distribute them into appropriate channels (Chen et al., 2008). Banking industry is one of the most important sectors of economic in all countries, and profitable banks are vital keys for a successful economic to any nations. Therefore, so many researches from the past up to now have taken banks efficiency and productivity in to account .

Meanwhile, Iranian banks as powerful financial institutes need to improve their performance .

Most of the Iranian Banks still use financial indicators to evaluate their performance. Financial aspects are past-based indicators and the only traditional performance evaluation measures. Therefore, they usually disregard important non-financial aspects in the systems while considering to only financial aspects is not enough to manage in a changeable business environment. However, the best monthly, semiannual, and even yearlong performance results cannot guarantee the same results in future.

Moreover, just considering financial metrics causes to focusing on only short-term objectives which results in losing long-term value added but short-term performance . For this purpose banks should first identify financial and non-financial indexes correctly to find a balanced basis for performance evaluation, because applying balanced approach ends in deeper understanding of all financial, customer, internal processes, and learning and growth perspectives. In this research, we present DEA- BSC model .This

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paper is organized as the following. In section two DEA and BSC approaches are explained. In section four, research methodology in addition to integrated DEA-BSC model are proposed. The results are also shown in section four. The conclusion is developed in section 5 .

LITERATURE REVIEW
- DEA History
The increased level of competitiveness is one of the characteristics of the new world and organizations which aim to improve their market share, profitability and as a result sustainability in current complex environments needs to adapt with environmental situation and change. In order to achieve such a goal organizations need to apply modern tools and scientific techniques. Among several techniques DEA is one of the accurate one in evaluating the organizations performance (Masoumzadeh, 2010)

DEA is a linear programming method which evaluates the relative efficiency of units in comparison to each other. There is no need to know a pre-assumption of production function and there is no limitation in inputs and outputs amounts .

Farrel (1957) by using a method similar to engineering efficiency measurement tried to evaluate the efficiency of one unit .

Farrel considered one input and output in his model. His study was contained of evaluating "technical efficiency" and "allocation" and "efficient production function derivative". Farrel used his model to estimate the efficiency of USA agriculture section in comparison to other countries. In spite of this, he was not successful in present a model which contains numerous inputs and outputs (Mehrgan, 2004)

The preliminary model of DEA developed by Charnes, Cooper, and Rhodes in 1978 (Cooper et al., 2006, 21). It had the ability to evaluate the efficiency using multiple inputs and outputs. This model called Data Envelopment Analysis and used in Rudez PhD thesis in 1976 for the first time whom supervisor was Cooper. In his thesis he evaluated the educational improvement of USA national schools and in 1978 it was presented in the article "evaluating the efficiency of decision-making units" (Mehgan, 2008)

In 1957 Charnes, Cooper, and Rudez added mathematical programming to Farrel non-parametric method which called CCR constant return to scale. Variable return to scale or BCC identified by Banker, Charnes, And Cooper in DEA models in 1984 (Safari and Azar, 2004)

So far, numerous models have been identified by researchers in this area and existence of more than 500 mathematical models and abundant applicable reports in the area shows its growth and development in productivity measurement (Azar and Motameni, 2004)

DEA is able to compare the efficiency of multiple decision-making units which by using multiple inputs and multiple outputs deliver similar services (Koskal and Aksu, 2007). Relative efficiency of a DMU is measuring by dividing weighted outputs to weighted inputs and compares with the efficiency score of other DMUs. The DMU which achieve 100% of efficiency considers as efficient DMU and the others with scores lower than 100% consider as inefficient DMUs (Lee et al., 2008)

In opposite of financial indices, DEA consider metrics by which it is possible to measure the overall organization productivity (Soteriou and Stavrinides, 1997)

Since DEA identified it has used in different applications e.g. R&D units (Lee et al, 2009), tourism industry (Bosetti et al, 2004), higher education (Dharmapala et al, 2007), hospitals (Al-Shammary, 1999), etc .

In banking industry DEA application has shown that it is applied in two ways. In the first approach it is applied to evaluate the specific bank branches efficiencies and in the second approach it is used to compare the efficiency of different banks . Based on Ho and Zhu (2004), Sherman and Gold (1985) seem to be one of the earliest people who evaluated bank branches. Following Sherman and Gold, some other researchers such as Soteriou and Stavrinides (1997), and Ramanathan (2006) studied about evaluating the efficiency of bank branches by using DEA.

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Table 1 provides a list of banks performance evaluation studies during the recent years

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Table 1: DEA in Banking industry		
Authors	Inputs	Outputs
Staub et al. (2009)	Financial credit Interest expense Capital Staffs	Deposits Loans Investments
Hassan et al. (2009)	Fixed assets Total investments	Total loans Other incomes from assets
Lin et al. (2009)	Number of staff Interest expense Deposit operating amount Current deposit operating amount	Loan operating amount Earning Operating revenue Interest revenue
Mokhtar et al. (2008)	Total deposits Total overhead expenses	Total earning assets
Bdour et al. (2008)	Staffs Total assets Total operating expenses	Total deposits Net direct credits Operating income
Kumar and Gulati (2008)	Physical assets Labor Loanable funds	Net interest income Non- interest income
Mostafa (2007)	Assets Capital	Net profit ROA ROE
Sufian (2007)	Total deposits Fixed assets	Total loan Other income
Ramanathan (2006)	Fixed assets Deposits Short-term deposits ROA Personnel expenses	Loans Other incomes
Wu (2006)	Labor General expenses	Deposits Incomes Loans
Soteriou and Stavrinides (1997)	Clerical personnel Managerial Personnel Computer terminals Working space Number of personnel accounts Number of saving accounts Number of business accounts Number of credit application accounts	Employee SQ perceptions of the bank branches

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Balanced Scorecard

Performance evaluation systems have changed a lot in comparison to the past. Modern techniques have more effective viewpoint and different structures comparing to the traditional method.

Balanced Scorecard (BSC) is a management tool which helps managers to examine their activities from different views. BSC consists of four perspectives including financial, customer, internal processes, and learning and growth perspectives and tries to make a balance between financial goals and the other remained perspectives (Najafi, et al., 2010).

Kaplan and Norton in research with 12 companies identified BSC approach and opened new doors to evaluate organizational performance by this managerial innovation (Kaplan and Norton, 2009, 14). They stated in their articles that firms in order to evaluate their performance should not only lend on financial aspects but also should consider their performance from customer, processes, and learning and growth view. The first generation of BSC was a set of metrics which could prepare an integrated view of business for the management. Balanced Scorecard was containing financial metrics- results of past activities- and operational metrics such as customer, internal processes, and learning and growth metrics (operational metrics which motive financial performance in future) (Kaplan and Norton, 2008, 11-14).
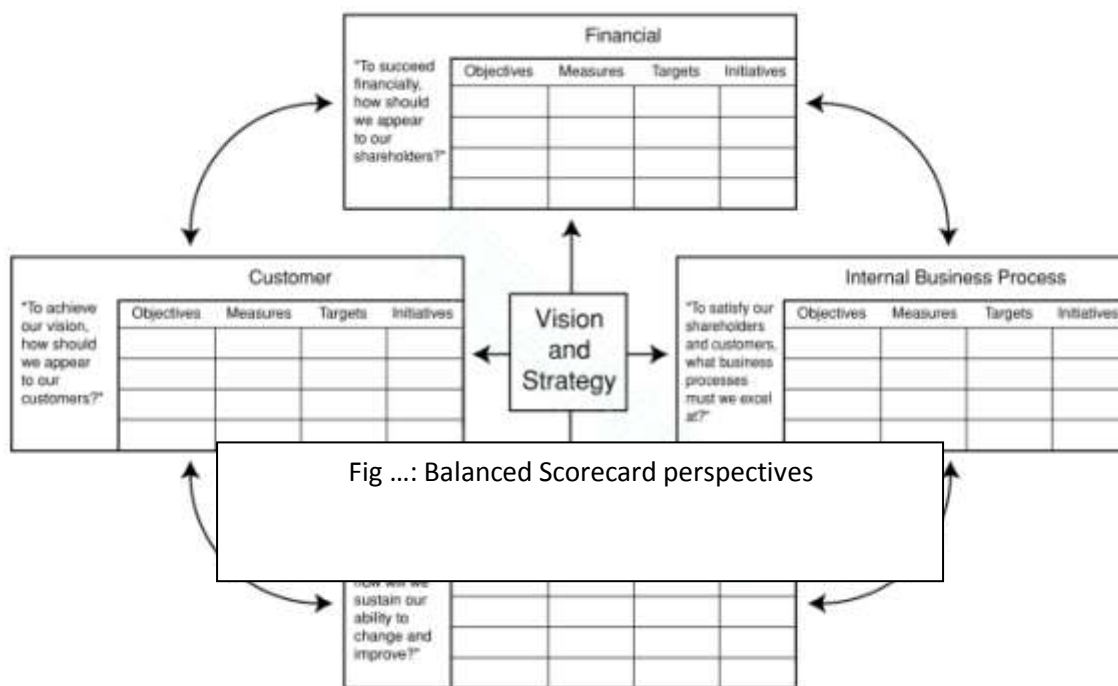

Fig …: Balanced Scorecard perspectives

Fig.1 demonstrates the details of balanced scorecard perspectives.

Different organizations have been used the idea of applying integrated DEA-BSC model .

Aryanejad et al. (2010) used an integrated DEA-BSC model in order to evaluate the efficiency of service industry. He used different inputs and outputs for each BSC perspective. Returned fund, cash deficit, and removed facility identified as learning and growths perspective inputs and incentive as the output. In internal processes, time efficiency and ATM productivity were chosen as inputs and Number of issued cards Internet, telephone and SMS bank selected as outputs. For customer perspective Aryanejad chose closed deposit and new customer as inputs and Number of issued cheques, foreign exchange, letter of credits, bill of exchange, bank statement, and foreign draft identified by him as the outputs to the model. In financial perspective expenditures and deposits were used as inputs and Income, deferred debt, and facility were chosen as the outputs.

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Valderama (2008) used the integrated DEA-BSC model and proposed a framework in order to analyze the relationship among the four BSC perspectives in R&D units by using DEA method. He also considered innovation perspective in addition to BSC four classic perspectives and identified some metrics for each perspective .

Min (2008) used DEA-BSC model in order to develop BSC to evaluate the efficiency of Korean hotels and showed that using the model, it is possible to identify specific strategies for each hotel and evaluate the effect of income improvement on hotels profitability. In his study he used Accommodation cost, hotel Employees, catering costs, and hotel catering department employees as inputs and number of rooms, hotel floors, hotel income, and restaurant income as outputs .

Chen (2008) by using an integrated DEA-BSC model in banks, showed that indicators selection affect performance results and performance evaluation. He showed that performance evaluation by using DEA usual indicators end in the same results as when financial indicators are being applied while using BSC indicators show different results. Labors, bank income, interest cost, deposits, fixed assets were considered as inputs and bank loans, interest income, and commission income were used as outputs in this study .Chen (2007) evaluated the performance of the semi-conductor industry in Taiwan. He showed that the efficiency of every domestic semiconductor manufacturer is generally good, and concerning the four perspectives of the BSC, the most important for the domestic firm is the financial perspective, second is the internal process perspective, third the learning and innovation. In this research employee predisposition, training, productivity, turnover rate, and research development used as inputs and income, profit rate, expense rate, turnover rate, market share, and sales return identified as outputs.

METHODOLOGY
In this paper 29 branches of a main Iranian Bank were evaluated and ranked during a one year period (2010). CCR out-put oriented model (enveloped form) was applied to assess the decision support systems (DMUs)

The BSC technique by a balance approach to different aspects of an organization and allocating score to each of these aspects enables managers to have a clear understanding of their organization performance, and make a proper decision at a suitable time. However, BSC provides no method in order to meet the objectives. Therefore, it is needed to use some other techniques in order to identify improvement path. In addition, although DEA has a high capability in performance evaluation and introducing improvement path; but does not help to identify inputs and outputs indices. As a result it needs another technique to provide suitable indexes (Aryanezhad et al, 2010)

Therefore, using an integrated DEA- BSC method comes with several advantages.

1. Organization recognition: in this step, organizations objectives and strategies are being identified and by using BSC technique the indices related to each perspective are being identified

2. Performance evaluation: designed metrics by BSC, will categorize into two groups including inputs and outputs and by applying DEA technique the performance evaluation is being performed .

3. Designing improvement path: by using DEA technique, improvement path is being identified for each metric. Improvement path for inputs is in order to decrease them and for outputs is in order to increase them .

4. Identifying indices objectives for the next evaluation period: indices objectives which are identified by DEA will be used as indices goals for next BSC implementation.

As a result, combining of these two models means to benefit of both techniques; secondly, combining these models caused the weaknesses of each model covered by the strengths of other model. The integrated DEA-BSC model is shown in Fig. 2.
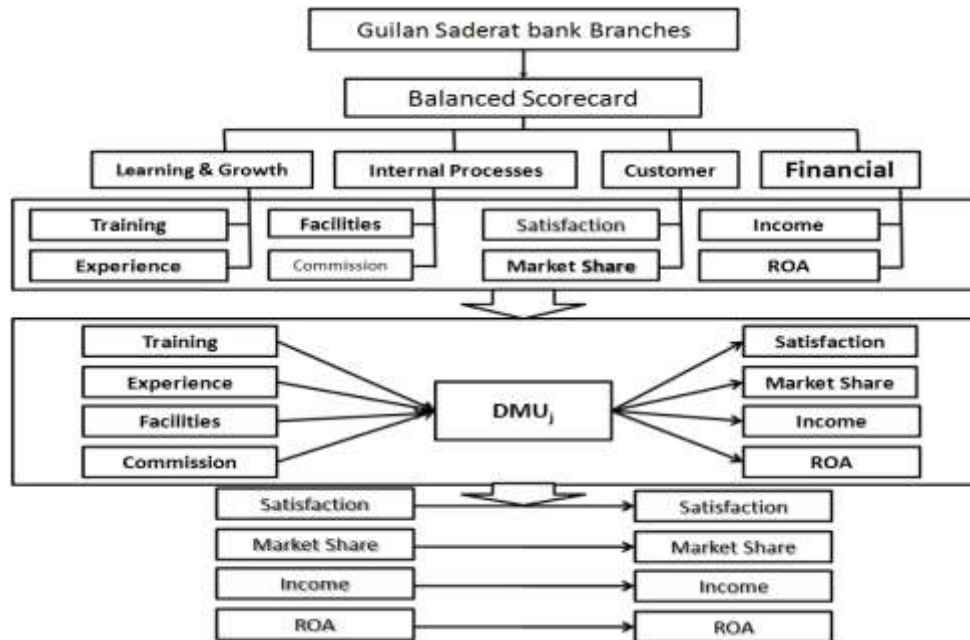
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Fig. 2: Integrated DEA-BSC model

There are some steps to the research that are expressed bellow:
Step1: Identifying effective factors to bank branches performance and choosing inputs and outputs to the research,
Step 2: Collecting Inputs and Outputs Data ,
Step 3: Evaluating bank branches performance by DEA,
Step 4: Performing AP evaluation method to rank efficient DMUs, and
Step 5: Final ranking ,
These steps will explain more in following:

Step 1. There were so many indicators to evaluate the performance of bank branches regarding to researches. After a wide study about banks balanced indicators with specific view to Iranian banks, inputs and outputs to the DEA model chose from the Iranian bank balanced indexes identified by Mehrgan (2005)
The inputs and outputs are shown in Fig. 3.
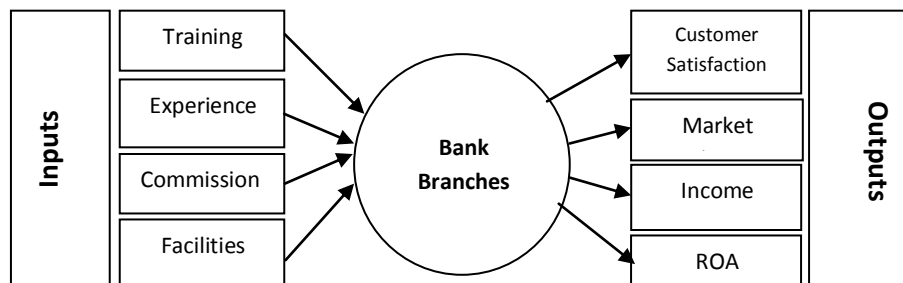

Fig. 3: Inputs and outputs to the model

Step 2. In order to collect data, for all indicators except customer satisfaction bank data base was used and by distributing questionnaire customer satisfaction data were collected.

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Step 3. In this level bank branches were evaluated by using CCR output-oriented model (enveloped form).

CCR output-oriented model (enveloped form):

$$Max \; Y_0 = \theta - \varepsilon \left(\sum_{r=1}^{s} s_r^+ + \sum_{i=1}^{m} s_i^- \right)$$

St:
$$\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = \theta y_{r0} \qquad (r = 1, \dots, s)$$
$$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = x_{i0} \qquad (i = 1, \dots, m)$$
θ Unrestricted in sign $\qquad \lambda_j, s_r^+, s_i^- \geq 0 \quad (j = 1, \dots, n)$

The results are shown in table 2.

	Table2: DEA preliminary results		
DMUj	**Efficiency**	**DMUj**	**Efficiency**
1	0.736	16	0.732
2	0.675	17	0.603
3	0.654	18	0.559
4	0.888	19	0.894
5	0.898	20	1
6	0.7107	21	0.956
7	0.729	22	0.563
8	1	23	1
9	1	24	1
10	0.946	25	1
11	0.733	26	1
12	0.672	27	1
13	0.9708	28	0.6901
14	0.967	29	0.832
15	0.778		

Step 4. In this level After solving the model as more than one branch were CCR-efficient and own Score '1', AP model applied in order to rank among efficient DMUs which results are shown in table 3.

	Table 3: Efficiency scores of efficient DMUs after applying AP model	
DMUj	**CCR**	**Rank**
8	0.065	7
9	3.84	1
20	2.627	2
23	1.31	6
24	1.628	4
25	1.062	8
26	1.63	3
27	1.5	5

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Step 5. Final ranking In this level and based on ranking among efficient branches, final ranking of the branches was done (table 4).

DMUj	Efficiency	Ranking	DMUj	Efficiency	Ranking
1	0.736	18	**16**	0.732	20
2	0.675	24	**17**	0.603	27
3	0.654	26	**18**	0.559	29
4	0.888	15	**19**	0.894	14
5	0.898	13	**20**	2.627	2
6	0.7107	22	**21**	0.956	11
7	0.729	21	**22**	0.563	28
8	0.065	7	**23**	1.31	6
9	3.84	1	**24**	1.628	4
10	0.946	12	**25**	1.062	8
11	0.733	19	**26**	1.63	3
12	0.672	25	**27**	1.5	5
13	0.9708	9	**28**	0.6901	23
14	0.967	10	**29**	0.832	16
15	0.778	17			

Table 4: Final ranking

CONCLUSION

In this paper the integrated DEA-BSC model proposed in order to evaluate the overall efficiency of a main bank in Iran. As managers In this research 29 listed branches of a main Iranian bank in Iran were evaluated and ranked. The application of CCR model in sample of 29 branches identified 8 (27.5%) branches efficient with efficiency scores 1 in 2010. The other branches with score between 0 and 1 are considered as inefficient . Results show that using CCR model DMU number 8, 9, 20, 23, 24, 25, 26, and 27 are efficient .Like other researches, this study also suffers from limitations . The main limitation to the research was the difficulty in gathering data for some specific indices. Therefore some indexes deleted because of lack of data and in this research just indices used which data was available.

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