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The Study of Efficiency and the Sensitivity Analysis of Management Accounting Operational Techniques and the Determination of the Optimum Structure Using the Data Envelopment Analysis Approach (Case study: Petrochemical Companies Listed on the Tehran Stock Exchange)

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ABSTRACT

The globalization and increase of commercial complexities along with the considerable growth in technology have led to the development of methods and techniques of management accounting. On the other hand, regarding the increasing development and importance of these techniques, their performance evaluation has become very noticeable. The present survey has been done to study the efficiency and analyze the sensitivity of management accounting operational techniques and to determine the optimum structure for the petrochemical companies listed on the Tehran Stock Exchange. This survey is an applicable and one-step research. The applied strategy is an analysis one based on mathematical modeling and by using the data covering analysis technique. Collection of the information has been done by using both the documents and the questionnaire. The geographic scope of the survey is the petrochemical companies listed on the Tehran Stock Exchange and its time scope is the year 1390. Designing and performing the suitable modeling for data covering analysis, the efficiency of the petrochemical companies listed on the Tehran Stock Exchange was identified. The results show that 10 companies that are approximately 48% of the petrochemical companies have a perfect efficiency that is 1. Also, ranking of the inputs and outputs by SAW showed that the budgeting techniques and the investment rate of return respectively from among the inputs and the outputs have the most importance in the petrochemical companies listed on the Tehran Stock Exchange.

KEY WORDS: Management Accounting Operational Techniques, data Envelopment Analysis, Fuzzy Analytic Hierarchy Process, SAW Technique, Optimum Structure.

1. INTRODUCTION

It is obvious that rational behavior and wise working are accompanied by human since the beginning of life. Therefore, productivity and efficiency have long been one of the human's interests. On one side, the human wants and desires are unlimited and in another side his power, facilities, tools, and time are limited. Therefore, the ideas of effective use of human resources inevitably tied to human and the concept of productivity and efficiency in its extensive meaning has attracted human's interest (Daneshvar, 2006)

Management accounting is a measurement system to collect financial and operational data that guides managerial activities, creates, and supports cultural value that is necessary to achieve its strategic goals. In twentieth century, management accounting did not have significant importance in industry but since then it started its development. Therefore, in comparison with other branches of accounting, this major is relatively new. With the move towards privatization, competition, changes in patterns, production, corporations' structure, speed up technology development as well as global trade, the importance of management accounting in business becomes obvious (Zimmerman and Morse 1997).

The use of basic and high-tech methods can be one of the important tools to improve performance. Use of these techniques makes it possible that in the changing condition; the organization changes its direction and makes its speed high in one area and slow in other areas to exploit from opportunities as much as possible. Using these basic methods, organizations would be able to take steps to improve weaknesses. By taking advantages from its power, the organization could lead ship of goals among the raging sea of changes to the best beach (Daneshvar, 2006).

Management accounting techniques are used for analyzing and interpreting financial information for better operational planning, control, and management of business unit's resources and lead to increased productivity and reduced costs. In recent years, the use of these techniques has grown dramatically due to changes in technology, changes in customer demand and increasing competition, so the impact of these tools on the performance of corporations is obvious (James Jim Ball, 2004).

The present paper is an attempt to identify the performance evaluation criteria -factors effecting performance- of corporations and to design a model for the performance evaluation of chemical companies in

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Tehran Stock Exchange by using data envelopment analysis. Obviously, only performance evaluation cannot lead to improvement. Therefore, in addition of explanation about the recovery effort, important inputs and outputs are identified by sensitivity analysis of designed models and by taking advantage of multi-criteria decision-making techniques in the following.

In section 2, the background of research is examined and in the next section, the research methods used are reviewed. After introducing the inputs and outputs used in Section 4, the research findings will be discussed in Section 5 and finally in section 6 summary, conclusions and recommendations of research are discussed.

2. RESEARCH LITERATURE

According to the research topic, the background is composed of two parts:

In the first part according to a survey conducted about the past papers, some researches done in the field of management accounting are examined.

In research done in 2011 in Iran, the management accounting situation in companies accepted in Tehran Stock Exchange is examined. The results show that 1.4% of the companies do not use any of the techniques of management accounting and 5.6% barely, 8.3% sometimes, 52.8% often and 31.9% always used this technique in their decision making process (HasasYeganeh, et al, 2011).

In another paper the relationship between organizational competitive strategy and management accounting system in the chemical and pharmaceutical industries and motor vehicles companies were examined. The results show that in all companies studied there is a significant relationship between the competitive strategy, organizational design and management accounting system with performance by contingency approach (Hejazi and Fotouhi, 2006).

Society of Management Accountants in 2009 examined the use of more than 100 management accounting tools divided to operational, managerial, and strategic groups by 439 respondents across the world. The results showed that most of the companies and organizations are using the limited number of management accounting tools and Balanced Scorecard is the most likely tool to be used more in two years later (CIMA, 2009).

In another paper in 2005, the use of seven management accounting tools by financial managers of U.S. universities were studied. The results of this study indicate that factors such as experience, education, and professional certification influence the use of management accounting tools (Margaret, 2005). Society of Management Accountants of the United States in 2003 considered the use of 17 management accounting techniques in form of four groups. Key results of the study showed that cost management is the main factor in strategic decision making and traditional management accounting tools are still widely used (IMA, 2003).

Must be acknowledged that one of the shortcomings of previous studies in management accounting research is the lack of examination of the management accounting techniques impact on the performance and efficiency. This study uses data envelopment analysis model to determine corporation efficiency and their optimum structure. Moreover, for macro planning of chemical industry with the ultimate goal of identifying priority inputs and outputs in the National Development Planning, the simple weighted sum technique is used to examine the importance degree of the inputs and the outputs.

In the second part, given that the DEA model is used in this study, some studies done in and out of the country in this area are explained. In one paper, the assessment and ranking of relative efficiency of automobile companies listed in Tehran Stock Exchange are discussed using data envelopment analysis approach. In this research, all companies of manufacturing auto parts in stock, including 29 companies during the period 2004-2006 were selected and after evaluating and ranking the relative efficiency of these companies, the results showed that 7 of the 29 companies on the basis of available information had enough efficiency (Rezaee, 2008).

In another study, the efficiency of the cement and mining companies listed in Tehran Stock is performed using data envelopment analysis to evaluate the relationship between companies' efficiency and stock returns in the period of 2003 to 2007. After measurement of the companies' efficiency using BCC and CCR models, they found that there is no relationship between these two variables (Jahanshad et. al, 2009). One Study in Taiwan used envelopment analysis data to compare the performance of research and development in integrated semiconductor manufacturers. In this study, a sample consisted of 52 firms in Taiwan since 1995 were selected. The results showed a significant difference between the R & D performances of compared companies (Chen Velin, 2006).

In a study in Greece, the evaluation of the cost effectiveness of a bank's network is discussed to examine the cost efficiency of banks by DEA models. In this study, a sample including 58 branches of this bank in six important cities of Greece were selected for the years of 2000 and 2001. The results indicated that the average rural branches are more efficient than urban branches. The sensitivity analysis of inputs and outputs showed that the branch size influences the performance (Nolans et al, 2008).

According to the previous paper, the management accounting techniques have not been used to evaluate the performance of the operating units, the innovative aspect of this research is the use of these techniques as an effective element and as an input data in envelopment analysis model.

3. RESEARCH METHOD

The research method is selected in order to the nature of the subject and research facilities. This study is classified as applied research. Implemented strategy is analysis strategy based on mathematical modeling. Location range of companies is the chemical industrial companies of the Tehran Stock Exchange including 28 companies that 21 of them responded to the questionnaire and the time domain of research is 2010. Given that the study was conducted in the numerous and varied steps and appropriate method is chosen for each step, implementation steps are as follows:

Step (1): In this step, the questionnaire of academic experts of the management accounting field was developed based on paired comparisons and the opinions of the respondents about preferred the main criteria and sub-criteria were collected at different levels of decision tree. Based on the received responses, the weights of main criteria and sub-criteria were determined via the phase analytic hierarchy process.

Step (2): In this step, the weight of each company in using these techniques were determined regarding the responses received from the questionnaires sent to financial managers of chemical industry companies -about their use of the operational techniques of management accounting operations - by SPSS software and using the weight of these techniques determined in the previous step.

Step (3): In this step, the rate of investment return, rate of equity return, economic added value and adjusted economic added value are determined based on the 2011 data set of the Tehran Stock Exchange official website and databases such as Rahavard-e Novin and Ara stock.

Step (4): In this step after the process of collecting inputs (step 2) and outputs (step 3), appropriate mathematical models were developed, and results were analyzed using SPSS software and WINQSB.

4. Input and output of model

In the present study to evaluate the operational efficiency of management accounting techniques, five operational management accounting techniques as inputs and four performance indices as outputs of DEA model were introduced. Table 1 shows the selected input and output:

Table (1): Introducing the inputs and outputs of the model

operational management accounting techniques	Costing Techniques	X_1	Inputs
	Pricing Techniques	X_2	
	Budgeting Techniques	X_3	
	Profitability Analysis Techniques	X_4	
	Investment decision Techniques	X_5	
performance indices	Rate of Equity Return	Y_1	Outputs
	Economic Added Value	Y_2	
	Rate of Investment Return	Y3	
	Adjusted Economic Added Value	Y4	

According to the adjustment of inputs and outputs and localizing them to ensure from proper and meaningful relationship between inputs and outputs, the correlation between them was examined. Table 2 shows the results of the correlation coefficient between them.

Table (2): the correlation between inputs and outputs

		Y1	Y2	Y3	Y4
X1	Pearson Correlation	0.856	0.762	0.699	0.767
	Sig. (2-tailed)	0.001	0.000	0.000	0.002
X2	Pearson Correlation	0.531	0.408	0.462	0.405
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
X3	Pearson Correlation	0.745	0.632	0.619	0.624
	Sig. (2-tailed)	0.000	0.001	0.003	0.000
X4	Pearson Correlation	0.462	0.461	0.384	0.483
	Sig. (2-tailed)	0.002	0.001	0.000	0.000
X5	Pearson Correlation	0.576	0.431	0.534	0.406
	Sig. (2-tailed)	0.000	0.001	0.000	0.000

Table 2 shows that all inputs have significant relationship with model outputs. Therefore, there is confidence about fitness between input and outputs of envelopment analysis model data

5. Research Findings

5.1. Weight of management accounting operational techniques based on phase analytic hierarchy process

Weighting technique is based on group decision-making process in phase hierarchical system. Therefore, the matrix of paired comparisons of each respondent in each case is combined as a group composition matrix. Therefore, at first, for all paired comparison matrices collection, the numbers were converted to the corresponding phase term and then adjustment rate of matrices was controlled. Its result for all matrices in all

level of hierarchical tree was equal to 0.07. The Weights of all the main criteria and sub-criteria based on the weighting techniques of management accounting is summarized in Table 3.

Table (3): The weights of management accounting operational weights based on FAHP model

Weight	Sub-Criteria	Weight	Criteria
0.49	RealCosting	0.549	Costing Techniques
0.319	NormalCosting		
0.191	StandardCosting		
0.68413	Costpluspercentage	0.179	Pricing Techniques
0.31587	Pricing on Purpose		
0.737	Comprehensive budget	0.125	Budgeting Techniques
0.263	FlexibleBudget		
0.622	Activity, Profit, Cost Analysis	0.070	Profitability Analysis Techniques
0.262	Productprofitabilityanalysis		
0.116	Customerprofitabilityanalysis		
0.425	Netpresent value	0.077	Investment decision Techniques
0.288	Internal rate of return		
0.139	ProfitabilityIndex		
0.086	Accountingrate of return		
0.062	Payback period		

5.2. Rating of Chemical Industry Companies Efficiencies

By design and implementation of output-oriented BCC model, performance of chemical companies listed in Tehran Stock Exchange was identified. In this model with variable returns to scale, 10 companies that are almost 48% of all companies had a performance of one. Among inefficient firms, Abadan Petrochemical Company with efficiency of 0.436 had the lowest efficiency. The results are shown in Table 4.

Table (4): output-oriented BCC model efficiency results

Company	efficiency	Rank	RTS	reference units
Pars Pamchal	1(0.597)	4	Fixed	
Fars Chemical Industries	0.791	13	Additive	0/132 Pars Pamchal + 0/137 KhargPetrochemical Co. + 0/01 Abadan Petrochemical Co. + 0/719 Iran inorganic salts company
Abadan Petrochemical Co.	0.436	21	Fixed	0/851 Pars Pamchal + 0/148 FanavaranPetrochemical Co.
AmirKabirPetrochemical Co.	0.554	17	Additive	0/03 JahromPetrochemical Co. + 0/34 KharkPetrochemical Co. + 0/322 FanavaranPetrochemical Co. + 0/30 Iran inorganic salts company
JahromPetrochemical Co.	1(0.05)	9	Additive	
KharkPetrochemical Co.	1(0.610)	2	Fixed	
Zagros Petrochemical Co.	1(0.510)	5	Fixed	
ShazandPetrochemical Co.	0.593	16	Fixed	0/369 Pars Pamchal + 0/14 KharkPetrochemical Co. + 0/228 Zagros Petrochemical Co. + 0/261 FanavaranPetrochemical Co.
Shiraz Petrochemical Co.	0.544	18	Additive	0/130 KharkPetrochemical Co. + 0/448 FanavaranPetrochemical Co. + 0/448 Iran inorganic salts company
FasaPetrochemical Co.	1(0.057)	8	Additive	
FanavaranPetrochemical Co.	1(0.644)	1	Fixed	
MarunPetrochemical Co.	1(0.604)	3	Fixed	
Pars Industrialsoot	0.633	15	Additive	0/2 Pars Pamchal + 0/066 Production ofchemical herbicides + 0/733 Iran inorganic salts company
Rangin Industry	1(0.077)	7	Additive	
Production ofchemical herbicides	1(0.005)	10	Additive	
Sina Chemical Industries	0.498	20	Additive	0/68 Pars Pamchal + 0/266 JahromPetrochemical Co. + 0/012 FanavaranPetrochemical Co.
KermanshahPetrochemical Industries	0.743	14	Fixed	0/494 Pars Pamchal + 0/02 KharkPetrochemical Co. + 0/387 Zagros Petrochemical Co. + 0/09 FanavaranPetrochemical Co.
Iran Chemical Industries	0.853	12	Fixed	1 FanavaranPetrochemical Co.
Leabiran	0.515	19	Additive	0/74 Pars Pamchal + 0/148 KharkPetrochemical Co. + 0/111 Iran inorganic salts company
Iran inorganic salts company	1(0.432)	6	Additive	
Nirukler	0.869	11	Additive	0/965 Pars Pamcal + 0/008 JahromPetrochemical Co. + 0/025 FanavaranPetrochemical Co.

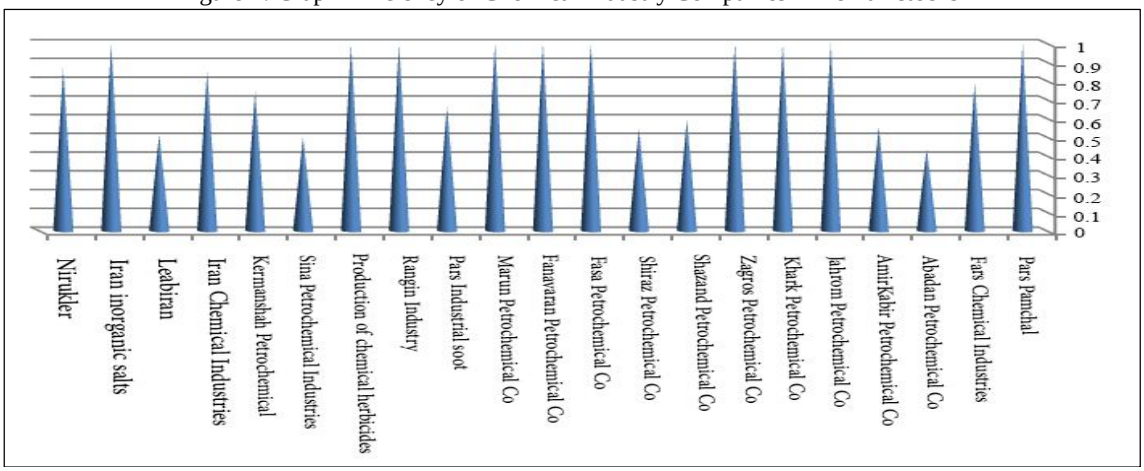
As it is obvious from the second column of the above table, efficiency scores of firms are in the range of zero and one. The companies with efficiency of one are considered as sufficient companies while companies with less than one degree are inefficient companies. Also in this column, the efficient units (the scale of 1) efficiency value based on the Anderson - Patterson method also calculated (figures in parentheses in the second column) and they are ranked again. In this way, the most efficient company is Fanavaran petrochemical company and other companies have been ranked in the third column, respectively. Given that according to the

data envelopment analysis, the obtained weights (shadow prices) are the most favorable weights to maximize efficiency units, it is probable that the efficiency of all units be equal to one.

The fourth column of the table shows returns to scale (RTS) of units. Returns to scale expresses the relation of changes between the input and output of a single decision maker. Returns to scale of a decision making unit is respondent to this question that if the inputs increase what changes occur on the output of decision making units. Returns to scale of decision-making unit can be divided into three types. If one of the inputs increase evenly and the outputs increase more than inputs, returns to scale is increasing.

If the inputs of a decision making unit increase evenly and its output increase equally, returns to scale is constant. If the inputs of a decision-making unit increase but the outputs increase lesser, returns to scale is decreasing. The fifth column presents reference units as the pattern units for inefficient companies and their combination to form a virtual unit. By the combination of inputs and outputs of reference units, the coordinates of the virtual model can be achieved for each inefficient unit and it can be considered as near-goal in direction of designing the plans. For example, the virtual unit for Shiraz Petrochemical Company is made from the combination of 103 for Khark Petrochemical Company, 448 for Fanavaran Petrochemical Company, and 448 for 0. Figure 1 shows the efficiency of companies in the chemical industry as a member of the Tehran Stock Exchange:

Figure 1: Graph Efficiency of Chemical Industry Companies in Tehran stocks



5.3. Sensitivity analysis of inputs and outputs

In this section by using data envelopment analysis model, the competitive positions of inputs and outputs or current problems are examined. To reach this goal, DEA models run repeatedly and in every period one input and one output is removed. Efficiency results of the model are given in Table 5.

Table (5): sensitivity analysis of inputs and outputs

Outputs				Inputs					Efficiency	Company
Y4	Y3	Y2	Y1	X5	X4	X3	X2	X1		
1	1	1	1	1	1	1	1	1	1	Pars Pamchal
0.791	0.791	0.791	0.720	0.659	0.791	0.791	0.791	0.746	0.791	Fars Chemical Industries
0.436	0.436	0.436	0.190	0.436	0.436	0.436	0.436	0.316	0.436	Abadan Petrochemical Co.
0.554	0.554	0.554	0.482	0.505	0.554	0.543	0.554	0.554	0.554	AmirKabirPetrochemical Co.
1	1	1	1	1	1	0.979	1	1	1	JahromPetrochemical Co.
1	1	1	1	1	1	1	1	1	1	KharkPetrochemical Co.
1	1	1	1	1	1	1	1	1	1	Zagros Petrochemical Co.
0.593	0.593	0.593	0.542	0.593	0.593	0.593	0.593	0.556	0.593	ShazandPetrochemical Co.
0.544	0.544	0.544	0.267	0.492	0.544	0.488	0.544	0.544	0.544	Shiraz Petrochemical Co.
1	1	1	1	1	1	1	1	1	1	FasaPetrochemical Co.
1	1	1	1	1	1	1	1	1	1	FanavaranPetrochemical Co.
1	1	1	1	1	1	1	1	1	1	MarunPetrochemical Co.
0.663	0.291	0.663	0.663	0.502	0.663	0.629	0.663	0.663	0.663	Pars Industrialsoot
1	1	1	1	1	1	1	1	0.186	1	Rangin Industry
1	1	1	1	1	1	1	1	1	1	Production ofchemical herbicides
0.498	0.498	0.498	0.382	0.498	0.498	0.356	0.498	0.498	0.498	Sina Chemical Industries
0.743	0.716	0.743	0.723	0.743	0.743	0.743	0.743	0.743	0.743	KermanshahPetrochemical Industries
0.853	0.853	0.853	0.680	0.853	0.853	0.757	0.853	0.853	0.853	Iran Chemical Industries
0.515	0.450	0.515	0.515	0.477	0.515	0.515	0.515	0.497	0.515	Leabiran
1	1	1	1	1	1	1	1	1	1	Iran inorganic salts company
0.869	0.869	0.869	0.561	0.869	0.869	0.810	0.869	0.869	0.869	Nirukler

As you can see in comparison of inputs and outputs, the second and the fourth inputs' and outputs' efficiencies haves not changed. This means that these inputs have not a significant impact on increase or decrease of companies' efficiency in the chemical industry. Meanwhile, with the removal of each of the remaining three inputs and two outputs the performance is reduced. The variables for chemical companies can be viewed as a competitive advantage of inputs and outputs and special attention to them are required. In fact the operation of taking advantages of the inputs and outputs of the corresponding chemical companies are done properly and it is required that experts of organization in addition of identifying its strength point, do proper planning to maintain their performance and transmission to other inputs and outputs.

5.4. The amount of improvement of recourses and performance indices

Productivity improvement is discussed as one of the major sources of economic growth and increases of the company's competitiveness so that the industrialized countries and successful developing countries achieved a significant portion of their production growth in this way (Alirezai et al, 2007). Given that the important role of productivity improvement in economic growth security, in the Fifth National Development Plan it has been mentioned that all executive agencies have to determine the portion of productivity improvement of related production growth. They must make some solution to convert the country from an input-oriented economy to output-oriented economy so that the contribution of total factor productivity growth in GDP increases (Pourkazemi and Soltani, 2009).

Thus, at this step, by using weights (shadow price) of the input and output obtained from different DEA models the optimal structure of resources and performance indices of chemical industry companies listed in the is Tehran Stock Exchange is determined. Table 6 shows optimum real values and the difference percentage of input sources and performance indices for all companies. Companies with maximum efficiency (100% efficiency of DEA models) act in optimal scale and there is no need to improve their input and output. Recovery rates of indices for other inefficient companies are specified in Table 6.

Table (6): the improvement rate of resources and the performance indices of chemical companies of Tehran Stock Exchange

Company	Pars Pamchal				Fars Chemical Industries			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	0.82	0.82	0	0.00%	0.9	0.9	0	0.00%
X2	0.54	0.54	0	0.00%	0.55	0.393	-0.157	-28.5%
X3	0.29	0.29	0	0.00%	0.29	0.283	-0.007	-2.26%
X4	0.18	0.18	0	0.00%	2	0.123	-1.877	-38.19%
X5	0.13	0.13	0	0.00%	0.09	0.09	0	0.00%
Y1	58.41	58.41	0	0.00%	37.09	46.9	9.81	26.46%
Y2	128871	128871	0	0.00%	510792	738560	227768	44.59%
Y3	0.86	0.86	0	0.00%	0.37	0.525	0.155	41.97%
Y4	57022	57022	0	0.00%	521071	658929	137858	22.46%
Company	Abadan Petrochemical Co.				AmirKabirPetrochemical Co.			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	0.86	0.86	0	0.00%	1.09	1.085	-0.005	0.00%
X2	0.72	0.502	-0.218	-30.14%	0.59	0.437	-0.153	-25.8%
X3	0.47	0.297	-0.173	-36.72%	0.34	0.34	0	0.00%
X4	0.21	0.178	-0.032	-14.99%	0.22	0.137	-0.083	-37.57%
X5	0.16	0.128	-.0.032	-19.68%	0.1	0.1	0	0.00%
Y1	26.39	60.50	34.11	129.26%	35.11	63.37	28.26	80.49%
Y2	145357	393144.5	247787.5	170.47%	396158	1996127	1599969	403.87%
Y3	0.14	0.84	0.7	500.53%	0.29	0.619	0.329	113.6%
Y4	74958	311632.7	236674.7	315.77%	1039700	1876557	836857	80.49%
Company	JahromPetrochemical Co.				KharkPetrochemical Co.			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	0.65	0.65	0	0.00%	1.36	1.36	0	0.00%
X2	0.24	0.24	0	0.00%	0.72	0.72	0	0.00%
X3	0.13	0.13	0	0.00%	0.44	0.44	0	0.00%
X4	0.15	0.15	0	0.00%	0.13	0.13	0	0.00%
X5	0.09	0.09	0	0.00%	0.1	0.1	0	0.00%
Y1	4.33	4.33	0	0.00%	83.27	83.27	0	0.00%
Y2	11709	11709	0	0.00%	3902381	3902381	0	0.00%
Y3	0	0	0	0.00%	0.75	0.75	0	0.00%
Y4	19694	19694	0	0.00%	3748534	3748534	0	0.00%
Company	Zagros Petrochemical Co.				ShazandPetrochemical Co.			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	1.36	1.36	0	0.00%	1.09	1.09	0	0.00%

X2	0.72	0.72	0	0.00%	0.66	0.54	-0.12	-18.04%
X3	0.44	0.44	0	0.00%	0.38	0.358	-0.022	-5.67%
X4	0.26	0.26	0	0.00%	0.22	0.188	-0.032	-14.28%
X5	0.16	0.16	0	0.00%	0.13	0.13	0	0.00%
Y1	82.91	82.91	0	0.00%	42.28	71.2	28.92	68.4%
Y2	5362952	5362952	0	0.00%	1378803	2321936	943133	68.4%
Y3	0.83	0.83	0	0.00%	0.43	0.803	0.373	86.89%
Y4	5064504	5064504	0	0.00%	1282486	2169749	887263	69.18%
Company	Shiraz Petrochemical Co.				FasaPetrochemical Co.			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	1.09	0.996	-0.094	-8.54%	0.65	0.65	0	0.00%
X2	0.6	0.338	-0.262	-43.51%	0.24	0.24	0	0.00%
X3	0.31	0.31	0	0.00%	0.22	0.22	0	0.00%
X4	0.2	0.138	-0.062	-30.52%	0.11	0.11	0	0.00%
X5	0.1	0.1	0	0.00%	0.08	0.08	0	0.00%
Y1	31.57	57.96	26.39	83.59%	4.42	4.42	0	0.00%
Y2	130635	1336845	1206210	923.34%	23087	23087	0	0.00%
Y3	0.17	0.593	0.423	248.88%	0.02	0.02	0	0.00%
Y4	165665	1225488	1059823	639.74%	27909	27909	0	0.00%
Company	FanavaranPetrochemical Co.				MarunPetrochemical Co.			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	1.09	1.09	0	0.00%	1.36	1.36	0	0.00%
X2	0.29	0.29	0	0.00%	0.66	0.66	0	0.00%
X3	0.34	0.34	0	0.00%	0.44	0.44	0	0.00%
X4	0.17	0.17	0	0.00%	0.26	0.26	0	0.00%
X5	0.12	0.12	0	0.00%	0.14	0.14	0	0.00%
Y1	72.53	72.53	0	0.00%	66.99	66.99	0	0.00%
Y2	1912717	1912717	0	0.00%	5920664	5920664	0	0.00%
Y3	0.73	0.73	0	0.00%	0.59	0.59	0	0.00%
Y4	1775644	1775644	0	0.00%	6436075	6436075	0	0.00%
Company	Pars Industrialsoot				RanginIndustry			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	0.82	0.808	-0.012	-1.38%	0.65	0.65	0	0.00%
X2	0.54	0.344	-0.196	-36.3%	0.42	0.42	0	0.00%
X3	0.25	0.25	0	0.00%	0.22	0.22	0	0.00%
X4	0.17	0.124	-0.046	-27.06%	0.17	0.17	0	0.00%
X5	0.09	0.09	0	0.00%	0.09	0.09	0	0.00%
Y1	11.09	39.21	28.12	253.64%	5.71	5.71	0	0.00%
Y2	97824	149653.3	51829.3	52.98%	80007	80007	0	0.00%
Y3	0.32	0.482	0.162	50.63%	0.05	0.05	0	0.00%
Y4	23285	79670.4	56385.4	242.15%	7842	7842	0	0.00%
Company	Production ofchemical herbicides				Sina Chemical Industries			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	0.65	0.65	0	0.00%	0.9	0.788	-0.112	-12.34%
X2	0.24	0.24	0	0.00%	0.6	0.446	-0.154	-25.52%
X3	0.13	0.13	0	0.00%	0.25	0.25	0	0.00%
X4	0.11	0.11	0	0.00%	0.2	0.171	-0.029	-14.26%
X5	0.08	0.08	0	0.00%	0.13	0.118	-0.012	-8.61%
Y1	0	0	0	0.00%	22.29	44.74	22.45	100.73%
Y2	0	0	0	0.00%	95563	191825.8	96262.8	100.73%
Y3	0.03	0.03	0	0.00%	0.24	0.623	0.383	159.98%
Y4	0	0	0	0.00%	22667	1378808.9	1356141.9	507.97%
Company	KermanshahPetrochemical Industries				Iran Chemical Industries			
	Real value	Optimal value	Difference	Difference Percent	Real value	Optimal value	Difference	Difference Percent
X1	1.09	1.067	-0.023	-2.07%	1.36	1.09	-0.27	-19.85%
X2	0.59	0.59	0	0.00%	0.66	0.29	-0.37	-56.06%
X3	0.38	0.356	-0.024	-6.23%	0.34	0.34	0	0.00%
X4	0.22	0.208	-0.012	-5.03%	0.22	0.17	-0.05	-22.73%
X5	0.14	0.14	0	0.00%	0.13	0.12	-0.01	-7.69%
Y1	51.94	69.82	17.88	34.43%	61.91	72.53	10.62	17.15%
Y2	491094	2414441	1923347	391.65%	1010994	1912717	901723	89.19%
Y3	0.62	0.833	0.213	34.43%	0.56	0.73	0.17	30.36%
Y4	303119	2246631	1943512	641.17%	1108537	1775644	667107	60.18%
Company	Leabiran				Iran inorganic salts company			
	Real value	Optimal	Difference	Difference	Real value	Optimal	Difference	Difference

		value		Percent		value		Percent
X1	0.9	0.9	0	0.00%	0.82	0.82	0	0.00%
X2	0.66	0.54	-0.12	-18.18%	0.3	0.3	0	0.00%
X3	0.34	0.307	-0.033	-9.48%	0.25	0.25	0	0.00%
X4	0.18	0.164	-0.016	-8.44%	0.11	0.11	0	0.00%
X5	0.12	0.12	0	0.00%	0.08	0.08	0	0.00%
Y1	26.93	59.77	32.84	121.97%	37.55	37.55	0	0.00%
Y2	105466	692360	586894	556.48%	168926	168926	0	0.00%
Y3	0.41	0.794	0.384	93.86%	0.42	0.42	0	0.00%
Y4	33271	607920	574649	999.9%	93090	93090	0	0.00%

Company	NiruKler			
	Real value	Optimal value	Difference	Difference Percent
X1	0.9	0.825	-0.075	-8.26%
X2	0.56	0.531	-0.029%	-9.99%
X3	0.29	0.29	0	0.00%
X4	0.18	0.18	0	0.00%
X5	0.13	0.13	0	0.00%
Y1	50.72	58.33	7.61	15.02%
Y2	151421	174170.7	22743.7	15.02%
Y3	0.47	0.849	0.379	80.78%
Y4	75484	101277.5	925793.5	34.17%

It is necessary to explain the calculation of optimum amount of resources and performance indices of inefficient companies in this part. As previously mentioned for inefficient Shiraz Petrochemical Company, the efficient companies of Khark petrochemical, Fanavaran petrochemical and Iran inorganic salts companies have been selected as the reference. In other words, the virtual unit for Shiraz is made from the combined resources and the performance indices of 123 for Khark Petrochemical Co., 448 for Fanavaran petrochemical Co. and 448 for Iran inorganic salts Co. Thus, the optimal values of Shiraz Petrochemical Co. are obtained as follows:

		KharkPetrochemical			**FanavaranPetrochemical**			**Iran inorganic salts**		**Optimal Value for KharkPetrochemical**
		↓			↓			↓		↓
		1.36			1.09			0.82		0.996
		0.72			0.29			0.3		0.338
		0.44			0.34			0.25		0.31
(0.103)	×	0.13	+ (0.448)	×	0.17	+ (0.448)	×	0.11	=	0.138
		0.1			0.12			0.08		0.1
		83.27			72.53			37.55		57.96
		3902381			1912717			168926		1336845
		0.75			0.73			0.42		0.593
		3748534			1775644			93090		1225488

Due to the optimum values, it is obvious that Shiraz Petrochemical Company has surplus in the first, second and fourth resources and these amounts must decrease to reach in optimum condition. However, the amounts of second and fifth resources are optimal. Similarly, the output of the first, second, third and fourth acts under optimal and to achieve full performance their level should increase to optimum value. For other companies, the optimum values are obtained similarly.

5.5. Priority investment of inputs and outputs

To schedule major Plans in chemical industry and to identify the priorities of the inputs and outputs, it is necessary to integrate the weights obtained from different models in the Master Plan for Development of these companies. Weights obtained from the various models show the inputs and outputs' performances in corresponding companies, so the overall significance of the ranking could achieve by integrating them. In this research to prioritize the inputs and outputs a general model of a simple weighted multi-criteria decision making techniques are used. Simple weighted sum model is one of the simplest and most common approaches in multi-pronged decision. Table 7 shows the ranking of research inputs and outputs.

Table 7: Ranking of inputs and outputs using a simple weighted sum technique

Outputs				Inputs					
Y4	Y3	Y2	Y1	X5	X4	X3	X2	X1	Variables
0.1532	0.20604	0.000014	0.03888	4.732	0.5227	11.353	2.222	2.764	Weight
2	1	4	3	2	5	1	4	3	Rank

6. Summary, Conclusions, and Recommendations

Management accounting is a branch of accounting that discuss about how the managers of commercial and non-commercial units use the accounting information and other financial information. Management accounting is

not restricted only to the field of accounting but wherever necessary, in economics, finance, statistics, operations research, and other related disciplines is used to provide useful information for management. The management with this information in hand will be able to manage more successfully planning and guidance of organization.

Due to the competitive market of chemical products, the industrial units' performance management has particular importance. Traditional approach just only consider the outputs of systematic performance of the organization while with a systematic approach it can be understand simply that the output reaching is just attainable by input imparting and using of appropriate processes. Therefore, only consideration of the outputs will cause error in the evaluation and performance management.

In order to overcome this shortcoming, the technique DEA (BCC output oriented model) has been used. In the first step of this study, the weight of each company in the amount of using these techniques is determined by getting feedback from experts in the field of management accounting through the Phase Analytical Hierarchy Process then these weights were used as the input data of envelopment analysis model.

In the second step, the rate of investment return, the rate of equity return, economic added value and adjusted economic added value calculated as four indices of performance for each company and were introduced as model outputs. In the third step, the DEA model used to measure the efficiency of the chemical industry companies of Tehran Stock Exchange and then through the sensitivity analysis of the inputs and outputs and using weights (shadow prices) of different DEA models, the optimal amount of inputs and outputs for deficient centers were determined.

The results show that ten companies from twenty-one companies of the chemical industry are efficient and the remaining eleven companies are inefficient. By sensitivity analyzes it was determined that three inputs of costing techniques, budgeting and decision making for investment and two outputs of rate of equity return and rate of investment return have a significant impact on the efficiency of these companies. It is noteworthy that the inputs and outputs can be qualitative and performance indices can be analyzed with methods that are more modern, and this could be a future research. In an overall conclusion, it can be said that the use of operational management accounting techniques in order to improve corporation performance will be a key and two criteria of rate of equity return and rate of investment return are two key criteria for assessing the performance of the companies.

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