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Article

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MANAGEMENT | RESEARCH ARTICLE

Data envelopment analysis technique to measure the management ability: Evidence from Iran Cement industry

Akbar Valizadeh Oghani¹, Farzin Modarres Khiyabani^{2*} and Nasser Fegh-Hi Farahmand³

Abstract: The purpose of this study is to measure the ability of management within the cement industry with a new pattern that has been a member of the Iranian stock exchange. With regard to this matter, the data of companies' financial statements from 2012 to 2016 were used. First, by implementing a suitable model and regional data envelopment analysis model, relative efficiency for each of the companies was calculated and the capable units have been ranking by Anderson-Peterson method as well, then a regression model was estimated. The indexes of company management abilities were calculated. To evaluate the relative efficiency optimization software GAMS and to determine the ability of management software E-Views were used. Our purpose was to achieve the non-inherent ability of managers in units. The result of the research shows that the efficiency or inefficiency of the companies can be related to the inherent and acquired ability of managers. The results indicate that companies that have been evaluated with a score productively, don't simply guarantee of the elevated ability of their managers (for example, Iran Chalk Co. & Ardabil Cement Co.). The ability of some companies' managers who

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PUBLIC INTEREST STATEMENT

This article is based on an academic study. The authors do not have the financial interest of this research. This is a purpose-oriented research. Its purpose to measure the ability of management within the cement industry listed on the Stock Exchange of Iran. The findings of this paper can be used by managers, shareholders and owners of cement industry companies in Iran and other countries.

have been Efficiently evaluated was also high (for example, Khuzestan Cement Co. & Mazandaran Cement Co.).

Subjects: Financial Mathematics; Mathematical Finance; Operations Research; Operational Research / Management Science

Keywords: Cement industry; relative efficiency; management ability; data envelopment analysis

1. Introduction

Shareholders want an appropriate rate of return on their investment. They want to maximize their returns. Thus, managers are highly motivated to utilize their abilities (Hajizadeh & Chenari, 2014). Increasing the efficiency of economic institutions is one way of the economic development of societies, thereby improving the living standards of a nation (Afsharkazemi et al., 2007). The attention to the management ability index is in a part related to the particular management features of the macro level and the high management pyramid and is part of their conceptual skills. Therefore, measuring the ability and talent of core management is the most important question on company performance, equity, shareholder value, investment decisions, rewards managers, differences in productivity, and economic effects on corporate ownership. Nowadays, management ability is one of the dimensions of human capital, which is classified as intangible assets. Demerjian et al. (2013) have described the management ability efficiency managers compared to competitors in a company's income sources. In this study, we try to introduce the ability to manage companies. To introduce the management ability of the Demerjian model, we try to extend it. We present a more complete model to measure the ability to manage companies from different aspects. Management ability is one of the factors influencing the company's operating efficiency. Han Li (2015) argues that managerial ability, especially the top executives' ability is closely related to the internal control quality. In his opinion, the ability to manage has two sections; first management point, by the calculated the efficiency is achieved rated managed and other compensations managerial, including the three levels of management in organizations (Li, 2015). Data Envelopment Analysis (DEA) is a very powerful service management and benchmarking technique originally developed to evaluate nonprofit and public-sector organizations. DEA has been proven to find ways to improve Invisible services with other techniques. Every organization can benefit from DEA in different ways, and DEA can be adapted to help improve efficiency & productivity. In fact, some managers are trying to use DEA based on their understanding of academic publications, however, they misunderstood the way to apply DEA (Cooper et al., 2004). This paper explains how DEA evaluates efficiency, how DEA identifies paths to improve efficiency. This will enable managers to explore and assess the value of using DEA in their service operations.

It seems that no research has ever been done on this topic in the cement industry. In this research, we try to introduce the ability to manage companies with data envelopment analysis techniques and provide a more complete set of criteria to measure the ability to manage companies from a variety of aspects. In fact, our motivation for this study is to help managers and owners of cement industry companies to evaluate performance and understand their inherent efficiency. We sought to determine the intrinsic value of companies, on the one hand, we have to assess the management ability of the DEA¹ technique. For the analysis, we used the GAMS software. Over the years, researchers in various aspects of value creation and wealth creation in the company have assessed and have identified factors that affect it as well. However, in this regard, it seems that invoice management skills and ability, it has been deleted or has been paid to it. Because it is intangible and difficult to measure (Matemilola et al., 2013).

There are many resources to produce cement in Iran. The cement industry is profitable and important for the Iranian economy. One of the most important reasons for choosing the cement industry as evidence for this research is the ability to value and export the derivatives.

2. Literature review

The ability to manage change leads to power, efficiency, and effectiveness which ultimately increases productivity and profitability of organizations. The management ability is one of the human capital indicators of companies and is considered as an intangible asset. Demerjian et al. (2013) defined the management ability as the efficiency of management relative to competitors in the conversion sources to the company's income. The ability to manage, related to the quality of internal control, and one of the most important achievements is also helping to increase shareholder wealth. In this case, Dechow et al. (1995) modified version of Jones (1991) used for detecting earning management. Capital expenditures are another indicator that affected the ability of corporate management in this study. We have used it as one of the indicators measuring the efficiency of cement companies. Fee and Hadlock (2003), noted that stock returned in the past period so that thereby, improve the ability to be managed. They have concluded that firms with high returns have high-potential managers. Raj Gopal et al. (2006), also measured the ability to manage using financial indicators. Hence DEA technique in computing is the ability to manage better compared to variables such as stock returns and firm size.

The management ability is considered to be the power of top executives. Management ability has two parts: one is the management point that is derived from the calculation of the company's efficiency, and the other is the management compensation (corrective actions) that includes the triple levels of management in the organizations (Li, 2015). The management ability means changing power, increasing efficiency and effectiveness, and ultimately the productivity and profitability of organizations.

The ability to manage is linked to the quality of internal control and one of its most important achievements is to help increase shareholders' profits (Li, 2015). Capital costs are another indicator that affects the management ability, which we have used in this study as one of the indicators of efficiency measurement of companies.

Yang (2017) shows that using developed DEA model can be the most efficient plan to reduce non-performing loans that can maximize the efficiency of the entire banking industry's control over the bad debts. Lee et al. (2017), used the DEA to measure the comparative efficiency of commercial banks. Han Li (2015) says that the ability to manage the quality of internal control is effective, but the effect is reduced over time. Andreou et al. (2013) showed that there is a positive relationship between the ability of companies and performance management, and the ability to manage, enhance performance and reduce the lack of investment. Leverty and Grace (2009) in these techniques to measure management ability, human factors are used as inputs and use financial distress indicators as outputs of the model. We have concluded that no matter how corporate managers have been stronger, fewer likelihoods of bankruptcy. Fee and Hadlock (2003) believe that there is a significant relationship between the ability to manage and stock returns. It means that companies with high stock returns are able managers, and efficient managers may be gone to other organizations and receive higher salaries and more benefits. Some researchers also have used to assess the efficiency of inside corporate data envelopment analysis. Some also used it to evaluate performance and net growth rates. Ehsan et al. (2003) have analyzed the financial statements of oil and gas companies using the DEA approach. They found that DEA is associated with financial ratios and provides information for decision-making. DEA has been applied in many situations such as health care (hospitals, doctors), education (schools, universities), banks (Rahman et al., 2016 & Yang, 2017), manufacturing, benchmarking, management evaluation (Andreou et al., 2013), fast-food restaurants, and retail stores. Chao et al. (2018), to measure the profitability efficiency and marketability efficiency used the convex meta-frontier data envelopment analysis model. Barat et al. (2018), used the Data envelopment analysis for decision-making unit with nonhomogeneous internal structures. Zakaria (2017), used the DEA approach to measuring bank risk management efficiency by using the financial derivatives.

In a situation where the Iranian economy is in dire need of revenue through non-oil exports, so increasing the managerial ability in the cement industry can help Iran's economy. In this study, the

companies of choice including the cement industry that were accepted by the Tehran stock exchange before 2012, and their shares are traded regularly and consistent with the rules of the stock exchange, have consistently published their financial reports and financial statements.

3. Methodology

This is purpose-oriented research, and its purpose is to measure the management ability within the cement industry listed on the stock exchange of Iran. Data relating to the indexes used, the information, and financial statements of companies during the years have been getting 2012 to 2016. Due to the use of past data, as a field kind of this research in terms of nature, ex post facto, and quasi-experimental. Researchers to present their findings, the first to collect data numerically, then to analyze these data have been used mathematical models based on DEA model. We selected evidence from 42 companies that are active in Iran's cement industry. We analyzed the data from these companies.

It seems that the patterns previously used to measure performance and management ability can't be suitable for Iranian companies. Because some indices information is not disclosed in Iran's cement companies. Therefore, we used the Demerjian et al. (2012) model to measure management ability. By modifying this template, we have changed the inputs and outputs based on what is presented in the financial statements of the sample companies in Iran.

In this paper, by technique DEA, output performance model is composed of the three factors: sales, economic value added and market value added, and model inputs include: cost of goods sold, selling expenses, administrative and general, finance costs, net of other costs, property, plant & equipment, intangible fixed assets (modified model of Demerjian). For assessing the relative efficiency of optimization and determining the ability of management, GAMS and E-Views software have been used, respectively.

4. Model of research

Recently, researchers such as Han Li (2015) in Chinese companies measured the efficiency of management. Furthermore, Salehi et al. (2014) have measured the efficiency of input and output of Iranian companies limitedly. In this study, an expansion pattern provided by Demerjian et al. is used (Demerjian et al., 2012) to measure the efficiency and ability to manage. We modified this model, its input and output according to what reported in the financial statements of companies in Iran. In the modern pattern, criteria such as an economic value added and market value added, as well as financing costs and average cost of capital are also added to it. Therefore, stages of improving the management ability index using the localized pattern have been following.

First step: The company's efficiency using DEA techniques and the following equation are measured:

$$\text{Max}\theta = \frac{(u_1 \text{Sales} + u_2 \text{MVA} + u_3 \text{EVA})}{(v_1 \text{CGS} + v_2 \text{SG\&A} + v_3 \text{FC} + v_4 \text{NOC} + v_5 \text{ACC} + v_6 \text{PPE} + v_7 \text{Intan})}$$

Output variables include; total sales, economic value added (EVA) and market value added (MVA), and input variables include; cost of goods sold (CGS), net selling expenses, administrative and general (SG&A), finance costs (FC), net of other costs (NOC), average cost of capital (ACC),² property, plant & equipment (PPE), intangible fixed assets (Intan).

Economic Value Added (EVA): The EVA is a scale the opportunity cost of all resources used in the company's consideration. Adding a positive value indicates the optimal allocation of resources, creating value, and increasing shareholder wealth is in company. On the other hand, adding a negative value represents a waste of resources, a non-optimal allocation, and inefficient resources which reduces shareholder wealth. In this formula, economic value added is a measure of internally to assess the performance with the company and managers (Assadi et al., 2014), which is calculated as follows:

$$EVA = NOPAT - (WACC * (\text{Total Asset} - \text{Total Current Debt}))$$

NOPAT: net operating profit after tax, WACC: the weighted average cost of capital it is calculated as follows:

$$WACC = K_d * W_d + K_e * W_e$$

K_d : interest rate debt*(1-T), equal to the rate of government participation bonds, 20% is considered. Since the stock exchange's corporate tax rate is 22.5% on average and according to law, the financial cost effective rate considered: $(1-22.5\%)*20\%$

W_d : total weight interest-bearing debt

$$W_d = \frac{\text{weight interest - bearing debt}}{(\text{market value of equity} + \text{total weight interest - bearing debt})}$$

W_e : the weight of equity cost of capital

$$W_e = \frac{\text{market value of equity}}{(\text{market value of equity} + \text{total weight interest - bearing debt})}$$

$$K_e = DPS \frac{1+g}{P_0} + g \&g = \left(\frac{EPS}{\text{Market Value of Equity}} \right) + \text{Percent Undivided Profit Percent}$$

$$\text{Undivided Profit} = 1 - \frac{DPS}{EPS}$$

Gordon model was used to calculate K_e ; DPS (dividends per share), EPS (earning per share), g (growth rate expected profit) & P_0 (price per share).

Market Value Added (MVA): An external criterion for evaluating the performance with the company and managers that will be calculated as follows:

$$MVA = \text{market value of equity} - \text{Book value of equity}$$

$$\text{MaxZ} = \frac{\sum_{r=1}^t u_r y_{r0}}{\sum_{i=1}^m v_i x_{i0}}$$

Subject to:

$$\frac{\sum_{r=1}^t u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1 \text{ For any company } j$$

$$u_r, v_i \geq 0$$

Linear programming model: This is the basic mathematical model of a linear fractional program. It should become a linear programming model to solve it the LP method.

$$\text{MaxZ} = \sum_r u_r y_{r0}$$

Subject to:

$$\sum_i v_i x_{i0} = 1$$

$$\sum_r u_r y_{rj} - \sum_i v_i x_{ij} \leq 0 \quad j = 1, 2, \dots, n$$

$$u_r, v_i \geq 0$$

To convert the linear programming model, we consider the denominator equal to 1 then we maximize the numerator (input-oriented model). This expression maximizes the numerator for the unit being evaluated, trying to assign the highest possible productivity rating. This expression sets the denominator to 1. This is related to the Charnes-Cooper transformation (Charnes & Cooper, 1961; Cooper et al., 2004). We use the same (weights) notions. In the data-oriented models, data reduced to be an efficient unit. The usual method of applying mathematical, model LP is changed as follows. By solving this model, the relative efficiency of each company can be obtained. The above expression in standard mathematical notation is:

The company's relative efficiency model designed for industry, each company's performance to compare the performance of companies operating within the industry. In this model also a coefficient specific to each of the input variables v , and for each output, variables were considered a coefficient u . Because the impacts of all input and output variables are not equal (Momeni, 2015).

The calculated value for efficiency is a number between 0 and 1. Whatever the value obtained is gone to 0 means that the efficiency is lower. Here the purpose of calculating the company's efficiency is measuring the ability of management. Since the efficiency computing, the manager also involved intrinsic properties, so do not be correctly measured the ability of management, because of these features influenced and more or less than the actual amount is calculated.

Second step: Demerjian et al. (2012), in order to control the effects of inherent properties to the company, the company's efficiency in two separate parts, the efficiency based on the congenital properties and management ability, have divided. We considered five special features of the company and called them control variables. The control variables include size of the company, market share, cash flow, life admission company in the stock exchange, export sales. Each of these variables that are inherent characteristics of the company, can help to management make better decisions, or acted in the opposite direction and restrict the management ability. These five characteristics are controlled in the following model.

However, management ability the use of efficiency achieved in the first phase, and the estimated regression equation with software E-Views is measured as follows:

$$\text{Firm Efficiency} = \beta_0 + \beta_1 \text{Size} + \beta_2 \text{MSH} + \beta_3 \text{FCF} + \beta_4 \text{Ln(Age)} + \beta_5 \text{BSC} + \beta_6 \text{FCI} + \varepsilon_0$$

Size is the company's size, $\text{Size} = \text{Ln}(\text{TotalAsset})$

MSH is the company market share j in a year t & $\text{MSH} = \frac{\text{Sales}_j}{\text{Total Industry Sale}_t}$

FCF is the free cash flow and shows the increase(decrease) in operating cash flow. In case of positive, $\text{FCF} = 1$ and in case of negative, $\text{FCF} = 0$ is considered. It is calculated from this formula: $\text{FCF} = \frac{(\text{OP} - \text{TAXP} - \text{CIP} - \text{DPP})}{\text{TA}}$, (OP is the profit operating, TAXP is the tax payable, CIP is the Interest expense payable, **DDP** is the Dividends payable & TA is the total asset)

LN (Age) is equal to the logarithm of the number of years that the company is listed on the stock exchange.

BSC is the business segment concentration, $\text{BSC} = \frac{\text{Commercial Sales}}{\text{Total Sale}}$

FCI is the foreign-currency indicator (Exports), for companies that export have 1, otherwise 0 is considered.

ε_0 : The residual of this model is the ability of the management company in efficiency.

5. Research findings

The implementation of data envelopment analysis at the cement industry (first step): By implementing the DEA model with the software GAMS, for each of the companies within the industry, the relative efficiency of each of them according to Table 1 for the years 2012 to 2016 was evaluated.

It should be noted that, in the data-oriented model, companies that are efficient points against 1 and companies with a score of less than 1 are considered to be inefficient. According to the results of Table 1 the number of 42 companies surveyed in the cement industry, the number of companies are proficient in 2012 with the 31 companies, in the years 2013 and 2014 the number of 30 companies, 27 companies in 2015, and in 2016, 21 companies were efficient. Other companies, inefficient during this period were evaluated. The number of companies is efficient in 2016 and the highest number corresponds to 2012. The results show that, on average, about 33% of the industry in recent years is efficient and 67% of companies in terms of relative efficiency were not in good condition.

Ranking the efficient units: According to the calculations in Table 1 a number of companies in 2016 with an efficiency equal to 1 that this is one of the problems in DEA models and in fact, is not the optimal resolution (Momeni, 2015). In this case, the model can't distinguish between multiple units to create efficiency. To overcome this problem and in order to rank the units, we have used the method of Anderson- Peterson. In this method, the ceiling limit efficiency score of 1 is evaluated companies that have taken in order, then the DEA model would have run. Results and prioritize the company, along with the efficiency scores for each of them is given in Table 2.

As shown in Table 2. It is clear, after running the model with Anderson-Peterson, the effective unit scores show that, among the companies in the cement industry in 2016, companies of the Fars & Khuzestan Cement, Neyriz Cement, Chalk Tehran, Giidc and Ardebil Cement industry, have the highest scores. Furthermore, Iran Chalk, Kerman Cement, Sarooj Bushehr & Soufian Cement was the lowest rank among the production companies.

Regression model to estimate the index of management ability in the cement industry (second step): The efficiency scores in Table 1 It is calculated. We have appointed it as the dependent variable in the above model. After estimating the regression model with the E-Views software, residual values (ϵ) that indicate the index of management ability of each company are calculated (In 2012–2016). The result from these calculations is given in Table 3.

Although some companies such as Iran Chalk, Ardabil Cement, Neyriz Cement, Kerman Cement and Chalk Tehran were efficient in all periods studied (Efficient score = 1), but the findings showed that Iran Chalk, Ardabil Cement and Neyriz Cement company, their managers are not efficient. While, companies such as Khuzestan Cement, Giidc Industries, Bagheran Cement and Mazandaran Cement during both the period under review have proficient and able managers.

6. Conclusions

The ability of the company's management to the macro-level attributes and skills are related companies. In the Iranian companies, the relative efficiency of the quantitative indicators depends on sales, value added, cost of production factors, financing costs, general costs, capital, the book value of tangible and intangible assets. The findings from this investigation, it appears that the efficiency or inefficiency of the company can be related to innate ability, artistic and adventitious managers. In this study, our purpose was to achieve non-essential ability of managers within the cement industry during the period 2012 to 2016. In order to provide a suitable model, the comparative efficiency the companies by DEA and using the software GAMS efficient units are determined and ranked by method Anderson-Peterson. Then it utilizes a linear regression model, the inherent characteristic of managers is controlled and the proportional efficiency is separated. The residual error of regression (ϵ) obtained from the software has been the management ability index. In the current situation, the Iranian economy needs to generate revenue through non-oil exports, and identifying the efficiency and management ability of the cement industry can help Iran's economy in this regard.

Table 1. The relative efficiency score, based on the CCR model—output in GAMS

Company/Year	2012	2013	2014	2015	2016	mean
Iran Chalk	1.000	1.000	1.000	1.000	1.000	1.000
giidc	1.000	1.000	1.000	1.000	1.000	1.000
Sarooj Bushehr	1.000	1.000	1.000	0.919	1.000	0.983
Cidco	1.000	1.000	1.000	1.000	1.000	1.000
Ardabil Cement	1.000	1.000	1.000	1.000	1.000	1.000
Urmia Cement	1.000	1.000	1.000	1.000	1.000	1.000
Isfahan Cement	0.889	1.000	1.000	1.000	0.928	0.963
Ilam Cement	1.000	1.000	0.892	0.933	0.752	0.915
Bagheran Cement	1.000	1.000	1.000	1.000	1.000	1.000
Bojnourd Cement	1.000	1.000	1.000	1.000	0.786	0.957
Behbahan Cement	1.000	1.000	1.000	1.000	0.959	0.992
Tehran Cement	0.729	0.953	0.591	0.664	0.608	0.709
Khash Cement	0.878	0.923	1.000	1.000	1.000	0.960
Khazar Cement	1.000	1.000	1.000	1.000	1.000	1.000
Khuzestan Cement	0.840	0.901	0.877	1.000	0.831	0.889
Darab Cement	1.000	0.725	0.656	0.668	0.729	0.755
Dashtestan Cement	1.000	1.000	0.807	0.966	1.000	0.954
Doroud Cement	1.000	1.000	1.000	1.000	0.845	0.969
Saveh Cement	1.000	1.000	1.000	1.000	1.000	1.000
Sepahan Cement	0.720	0.852	0.974	0.810	0.824	0.836
Neyriz Cement	1.000	1.000	1.000	1.000	1.000	1.000
Shahrood Cement	0.988	1.000	1.000	0.891	1.000	0.975
Sharg Cement	0.617	0.749	1.000	0.703	0.609	0.735
Shomal Cement	0.602	0.683	0.536	0.700	0.632	0.630
Soufian Cement	1.000	0.876	0.930	1.000	1.000	0.961
Gharb Cement	1.000	1.000	1.000	0.861	0.808	0.933
Gharbasia Cement	1.000	1.000	1.000	0.743	0.617	0.872
Fars Cement	1.000	0.868	1.000	0.862	0.914	0.928
Farsnov Cement	0.916	0.936	0.936	1.000	1.000	0.957
Fars & Kh. Cement	1.000	1.000	1.000	1.000	1.000	1.000
Qayen Cement	1.000	1.000	1.000	0.944	0.988	0.986
Sabzevar Cement	1.000	1.000	1.000	1.000	0.643	0.928
Larestan Cement	0.702	1.000	0.844	0.736	0.600	0.776
Mazandaran Cement	1.000	1.000	1.000	1.000	1.000	1.000
Majd-khaf Cement	1.000	1.000	1.000	0.657	0.790	0.889
Momtazan Cement	1.000	1.000	1.000	1.000	1.000	1.000
Hormozgan Cement	1.000	1.000	1.000	1.000	1.000	1.000
Hegmatan Cement	1.000	0.924	1.000	1.000	0.811	0.898
Karoon Cement	1.000	0.811	1.000	1.000	0.681	0.898
Kordestan Cement	1.000	1.000	0.969	1.000	0.750	0.943
Kerman Cement	0.907	1.000	0.815	1.000	1.000	0.944

(Continued)

Company/Year	2012	2013	2014	2015	2016	mean
Chalk Tehran	1.000	1.000	1.000	1.000	1.000	1.000
The mean relative efficiency of cement industry	0.947	0.957	0.948	0.929	0.883	0.932
The number of efficient companies in the cement industry	31	30	30	27	21	14
The number of inefficient companies in the cement industry	11	12	12	15	21	28

Table 2. Ranking the efficient units by Anderson-Peterson method (In 2016)

Rank	Company	Final Score
1	Fars & Kh. Cement	220.458
2	Neyriz Cement	49.132
3	Chalk Tehran	34.662
4	Giidc	26.416
5	Ardabil Cement	10.369
6	Urmia Cement	5.757
7	Saveh Cement	3.63
8	Cidco	3.506
9	Khazar Cement	3.34
10	Hormozgan Cement	3.024
11	Bagheran Cement	1.523
12	Momtazan Cement	1.166
13	Farsnov Cement	1.146
14	Dashtestan Cement	1.142
15	Mazandaran Cement	1.135
16	Khash Cement	1.102
17	Soufian Cement	1.062
18	Sarooj Bushehr	1.011
19	Kerman Cement	1.001
20	Iran Chalk	1.000

The result indicates that nearly one-third of cement companies during the period under review are efficient and two-thirds are inefficient. The evaluated companies with higher efficiency can't be guaranteed to have a higher ability to manage. This claim in companies like Iran Chalk, Ardabil Cement, Neyriz Cement and Kerman Cement clearly identified. On the other hand, the results show that some companies such as the Giidc Industries, Khuzestan Cement, Bagheran Cement and Mazandaran Cement efficient assessment and the ability of their managers are also higher. Among the companies more competent, Fars and Khuzestan Cement, Neyriz Cement and Chalk Tehran have the highest efficiency and companies of the Iran Chalk, Kerman Cement and Sarooj Bushehr had the lowest efficiency. Other research studies showed that the ability of management, performance indexes and indexes of stock returns will strengthen (Andreou et al., 2013; Fee & Hadlock,

Table 3. Scores management ability on the regression model—output in E-Views

Company/Year	2012	2013	2014	2015	2016	mean
Iran Chalk	0.003	0.018	0.022	0.039	0.053	0.027
Giidc	0.059	0.091	0.099	0.104	0.118	0.094
Sarooj Bushehr	0.071	0.054	0.065	−0.005	0.070	0.051
Cidco	0.044	0.070	0.101	0.120	0.122	0.091
Ardabil Cement	0.025	0.028	0.040	0.042	0.048	0.037
Urmia Cement	0.061	0.061	0.066	0.076	0.075	0.068
Isfahan Cement	−0.067	0.045	0.050	0.061	−0.002	0.018
Ilam Cement	0.059	0.052	−0.066	−0.017	−0.196	−0.034
Bagheran Cement	0.038	0.109	0.039	0.050	0.180	0.083
Bojnourd Cement	0.035	0.045	0.054	0.062	−0.143	0.010
Behbahan Cement	0.014	0.025	0.036	0.045	0.012	0.027
Tehran Cement	−0.200	0.032	−0.299	−0.217	−0.255	−0.188
Khash Cement	−0.090	−0.048	0.045	0.052	0.058	0.004
Khazar Cement	0.003	0.066	0.068	0.078	0.074	0.057
Khuzestan Cement	−0.129	−0.04	−0.059	0.063	−0.101	−0.054
Darab Cement	0.063	−0.210	−0.265	−0.239	−0.176	−0.165
Dashtestan Cement	0.047	0.053	−0.133	0.037	0.074	0.016
Doroud Cement	0.045	0.049	0.057	0.063	−0.074	0.028
Saveh Cement	0.080	0.087	0.090	0.097	0.096	0.090
Sepahan Cement	−0.173	−0.046	0.086	−0.062	−0.067	−0.053
Neyriz Cement	0.008	0.022	0.026	0.030	0.033	0.023
Shahrood Cement	0.040	0.036	0.067	−0.032	0.079	0.037
Sharg Cement	−0.309	−0.175	0.078	−0.201	−0.282	−0.178
Shomal Cement	−0.278	−0.183	−0.324	−0.134	−0.207	−0.225
Soufian Cement	0.114	−0.036	0.045	0.114	0.116	0.070
Gharb Cement	0.063	0.066	0.073	−0.060	−0.110	0.006
Gharbasia Cement	0.049	0.162	0.170	−0.080	−0.196	0.021
Fars Cement	0.070	−0.056	0.086	−0.035	0.022	0.017
Farsnov Cement	−0.075	−0.048	−0.038	0.036	0.042	−0.017
Fars & Kh. Cement	0.142	0.150	0.145	0.152	0.161	0.150
Qayen Cement	0.033	0.06	0.056	0.013	0.060	0.039
Sabzevar Cement	0.018	0.045	0.042	0.060	−0.296	−0.026
Larestan Cement	−0.274	0.009	−0.105	−0.211	−0.338	−0.184
Mazandaran Cement	0.069	0.072	0.076	0.089	0.096	0.080
Majd-khaf Cement	0.038	0.047	0.055	−0.240	−0.153	−0.051
Momtazan Cement	−0.014	−0.003	0.033	0.046	0.046	0.022
Hormozgan Cement	0.044	0.053	0.055	0.080	0.067	0.060
Hegmatan Cement	0.033	−0.022	0.059	0.068	−0.115	0.005
Karoon Cement	−0.183	−0.127	0.079	0.073	−0.239	−0.081
Kordestan Cement	0.009	0.025	0.013	0.052	−0.181	−0.017
Kerman Cement	0.001	0.099	−0.065	0.141	0.142	0.063
Chalk Tehran	−0.104	−0.008	−0.005	−0.003	0.004	−0.024
The mean of the management ability index of cement industry	−0.012	0.017	0.012	0.010	−0.031	0.000

2003). Whatever managers had a greater ability to invest with more risk doing and boost profitability. According to Leverty and Grace (2009), capable human resources are one of the important factors in improving management ability and reduce the likelihood of bankruptcy. Some researchers believe that the most appropriate way to measure of management abilities is DEA technique. Some results are based on theoretical and background research, show that an ability to manage has a positive impact upon the quality and sustainability of earnings (Mansourfar et al., 2015), and their financial reports are of the higher quality (Piri et al., 2015).

The results of implementing the data envelopment analysis model show that efficient companies often do not necessarily have able managers. It is suggested to companies of the cement industry, which evaluates management performance, the index of relative efficiency and management ability cannot be considered separately. Most of the sample companies in this research are corporations and some are also run in a state or semi-government structure, therefore, generalizations of findings to small and corporate companies are not logical and should be carried out with caution. Some uncontrollable variables such as inflation, price index, and interest rates may affect the relative efficiency of companies that are not mentioned in this paper. The findings of this study can be useful and practical for some countries with a similar economy scale. The findings of this research can be used in policy evaluation of the performance of their managers also, can be used by managers, shareholders and owners of cement industry companies in Iran and other countries.

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Notes

1. Data Envelopment Analysis.
2. The Weighted Average Cost of Capital ($ACC = WACC^*$ (Total asset- Total current debt).

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