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Using VIKOR Method in the Performance Evaluation Cement Industry

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Abstract. Aim of this research is performance evaluation cement industry by VIKOR method. Investors have problems in selecting companies for investment and perhaps their assets be missed by mistake selection by the companies. We will meet this problem in this research by a method which is introduced for investment and will help investors to make the best selection and it leads to improvement and progress in cement industry and by this manner , we will support national production. VIKOR method is multi attribute decision making method. liquidity , profitability , activity , financial leverage and growth financial ratios are main criteria. our statistical society is all 28 cement companies which accepted in Tehran Stock Exchange and simple and society is equal. In this research, the method is measuring descriptive method and based on and practical applicable goals. Time domain is (1379-1388) and space domain is Tehran stock exchange. Based on results of this research , a set of Shomal , Ardabil and Azar Shahr lime , Khash , Esfahan , Kordestan , Mazandaran , Shargh cement companies are optimal decision for investment .

Keywords: Financial Ratios, VIKOR Method , Investment , Cement Industry.

1. INTRODUCTION

Development and Globalization economic activities particularly investment activities is causes complicates the management and above all decision making. Appropriate decision making is required more information about variety sciences and technology. The problem is that investors have difficulty in selection decision making the companies for themselves investments and their capital is wasted if they choose the wrong. We have considered liquidity, profitability, activity, leverage financial and growth criteria that are obtained based on financial ratios for investment in Cement companies and also by VIKOR[1] method that is one compensatory multi attribute decision making methods action will ranking Cement companies based on criteria and in this way, are characterized the best options for investment and in this way, solving difficult.

1.1 Background

It is clear that identify organization performance criteria is necessary according to rapid changes in the conditions that each of the criteria have themselves particular importance degree. Another vacuum that is in this context, it is about ranking methods in Tehran stock exchange that now is two methods. The first method is ranking based on a criteria that it usually be considered sale and has low reliability and the second method is harmonic mean that it more focuses on capital markets supply and demand that focuses on effect rather than cause. We used multi attribute decision making methods and we rankings companies based on multi criteria and is removed weakness. Hastily growth in sciences and technology that provide accountability tools to decision making needs, which was form new branch of science in management.

[1] ViseKriterijumska Optimizacija I Kompromisno Resenje

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Financial management is the process result. The relationship between management and decision making speeds mechanism. Investment is main base and cause survival and increased power in the business activities. Nature of Investment is not usually renewable but it is long-term and a selection is between solutions.[1] Also multi criteria decision making topic that is operational research topic. It is useful in the more investment decisions. Decision making models are divided to two major categories: multi objective models and multi criteria models. The multi objective models are used to designing while the multi criteria models used to choose the best option.[2] In the past two decades, researchers have regard to multi criteria decision making models. In this kind of decision making are considered multi criteria that sometimes there are conflicting between them that in everyday life occur regularly. Our goal in this research is used to VICOR method for ranking and choose the best option from between Cement companies accepted in exchange based on liquidity, profitability, activity, leverage financial and growth criteria for optimal investment decision making of investors.

2. RELEVANT STUDIES

In this section, a number of studies that have been carried out in this area is. Research by Rangriz and et al (2012) done as Performance Evaluation of Iran Cement Companies based on AHP and [2]TOPSIS Methods. Purpose of this study is representing manners which select the problem and solve ranking optimally by multi criteria decision making methods and by high ability. If the manners are combined correctly, by power keeping of each ways, its weakness will be offset by other powers. In this research, the method is measuring descriptive method and based on and practical applicable goals. For using conceptual model in the company's performance evaluation, statistical society is all cement companies which accepted in Tehran Exchange Markets since (1379 to 1388). In this study, a combined method (TOPSIS- AHP) in the company's performance evaluation is presented by financial ratios. Financial ratios weights respected to views of different groups of experts are determined by AHP and thus, each ratio is used by its importance in the performance of firm evaluation and ranking of each firm is determined by TOPSIS method. based on implemented ranking, Ardabil and Azar Shahr lime cement company have the first ranking indicates that some criteria such as growth , profitability, liquidity , activity and financial leverage are combined method (TOPSIS-AHP) is better than uncombined one.[3] Another study conducted by Amiri (1386) as the decision to select a machine tool using fuzzy VIKOR method. Select the appropriate machine tools due to a manufacturing company is crucial influence on the production process. Inaccurate information makes it more difficult to select. VIKOR method is a new method for solving multi-criteria decision-making that It aims to select the best option based on the nearest possible answer is the ideal answer. In this paper, an approach for fuzzy VIKOR method has been proposed that Ranking the options and the criteria weights are considered as fuzzy numbers. It also comments on the proposed method of weight decision makers, considered to be different.[4]

3. MATERIAL AND METHODS

Research method, descriptive survey is based on the type of application. In this study, data collection method is the documents and field. Questionnaire and time series data (1379-88) is to

[2] Technique for Order Preference by Similarity to Ideal Solution

collect data. The population in this study is all 28 cement companies listed in Tehran Stock Exchange and the sample size is equal society.

3.1 Financial Ratios

Financial ratios are useful indicators for the performance and financial position of the company. Financial ratios ranking according to Information provided.[5]In this research, we will discuss five main criteria of the financial ratios with fourteen sub criteria that they are growth ratio with sub criteria sales growth, operating profit growth, shareholders equity, assets growth; profitability ratio with sub criteria net profit margin, return on assets; liquidity ratio with sub criteria current, quick, cash; activity ratio with sub criteria total asset turnover, working capital turnover; leverage financial ratio with sub criteria debt , long term debt to shareholder's equity, fixed assets to shareholder's.

3.1.1 Lıquıdıty Ratıos

Liquidity ratios measures the company's ability in preparing the sufficient cash for business leadership in the following months.[6] In other words, liquidity ratios measures the company's power and ability in refund short-term debts. Ratios that measure the company's liquidity are current, quick, cash ratios.[5]

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}} \quad (1)$$

$$\text{Quick Ratio} = \frac{(\text{Current Assets} - \text{Inventories})}{\text{Current Liabilities}} \quad (2)$$

$$\text{Cash Ratio} = \frac{(\text{Cash} + \text{Marketable Securities})}{\text{Current Liabilities}} \quad (3)$$

3.1.2 Profitablity Ratios

Profitability ratios used to measure of the income adequacy. Profitability ratios used to operational activities evaluation of companies.[7] Anyone whose economic interests are tied to the long term survival of a company will be interested in it.Ratios that measure the company's profitability are:

$$\text{Net Profit Margin Ratio} = \frac{\text{Earning after taxes}}{\text{Sales}} \quad (4)$$

$$\text{Return on Assets Ratio} = \left(\frac{\text{Net Profit}}{\text{Assets}}\right) * 100 \quad (5)$$

3.1.3 Activity Ratios

Activity ratios used to operation period evaluation and composition of current assets of companies. Composition of current assets refers to what amount of current assets of the company is converted rapidly to the cash. Ratios that measure the company's activity are:

$$\text{Total Asset Turnover Ratio} = \frac{\text{Sales}}{\text{Total Assets}} \quad (6)$$

$$\text{Working Capital Turnover} = \frac{\text{Net sales}}{\text{working capital}} \quad (7)$$

3.1.4 Leverage Fınancıal Ratios

Ratios are that evaluating the relationship financial resources of the company accounting to current debts, long term debts, shareholder's equity and how to combine them. Leverage financial ratios compare cash that provided to investment from the creditors and ratios measures them. Ratios that measure the company's leverage financial are:

$$\text{Debt Ratio} = \frac{\text{Total Debt}}{\text{Total Assets}} \quad (8)$$

$$\text{Long-term Debts to Shareholder's Equity Ratio} = \frac{\text{Long-term Debts}}{\text{Shareholder's Equity}} \quad (9)$$

$$\text{Fixed Asset to Shareholder's Equity Ratio} = \frac{\text{Fixed Asset}}{\text{shareholder's Equity}} \quad (10)$$

3.1.5 Growth Ratios

Growth ratios indicate how well the position of the company in the industry.[8] Ratios that measure the company's growth are:

$$\text{Sales Growth} = \left[\frac{(St - St-1)}{St-1}\right]*100 \quad (11)$$

Here, St = Net sales of the current period

St-1 = Net sales of the previous period

$$\text{Operating Profit Growth} = \left[\frac{(Pt - Pt-1)}{Pt-1}\right]*100 \quad (12)$$

Here, Pt = Operating profit with current prices

Pt-1 = Operating profit of the previous period

$$\text{Shareholders Equity Growth} = \left[\frac{(Et - Et-1)}{Et-1}\right]*100 \quad (13)$$

Here, Et = Shareholders Equity of the current period

Et-1 = Shareholders Equity of the previous period

$$\text{Assets Growth} = \left[\frac{(At - At-1)}{At-1}\right]*100 \quad (14)$$

Here, At = Assets of the current period

At-1 = Assets of the previous period.

3.2 VICOR Method

VICOR method is an effective tool in the compensatory Multi Criteria Decision Making and it used in solving the problems that are associated with the inconsistent and disproportionate criteria. This method used in the absence of that decision maker not able to express at the beginning of system design its preferred. In this way, decision maker solution is needed that the solution is closest to the ideal solution.

Stages of the VICOR method:

1. Formation the decision matrix
2. Not scale the Matrix decisions

In VICOR method used of the normalizing fuzzy for not scale the Matrix decisions that this will be in the method of calculation formulas. The advantage of this not scaling is linear and total Results are converted to a linear relationship and consequently, the relative order of the results remains the same.

3. Determine to criteria weight

Criteria weight is expression preferences of decision maker means it is expression the relative importance of each criterion and be determined at this stage.

4. Determine to the best and worst values for each criterion in the decision matrix between the available values.

Best and worst values A_i^+ , A_i^- all the options are selected. If show interest, we will:

$$A_i^+ = \max_j A_{iJ} \quad , \quad A_i^- = \min_j A_{iJ} \tag{15}$$

If I show cost, we will:

$$A_i^+ = min_j A_{iJ} \quad , \quad A_i^- = max_j A_{iJ} \tag{16}$$

5. Calculate values R , S

Maximum utility of the majority group is shown with S and minimum individual regret of the opponent is shown with R.

$$S_j = \sum_{i=1}^{n} W_i(A_i^+ - A_{iJ}) \,/(A_i^+ - A_i^-) \tag{17}$$

$$R_j = \max_j \left[W_i(A_i^+ - A_{iJ})/(A_i^+ - A_i^-)\right] \tag{18}$$

6. Calculate values Q

Q is synthetic function. It called the advantage function that incorporate R, S with weight V The equation. Synthetic function should be used with great caution because of the possibility of an analogy isn't to compare quantities.

$$Q_j = V(S_j - S^+) / (S^- - S^+) + (1 - V)(R_j - R^+)/(R^- - R^+) \quad (19)$$

Where

$S^+ = Min_j S_j$, $S^- = Max_j S_j$, $R^+ = Max_j S_j$, $R^- = = Min_j S_j$ (20)

And V as the maximum amount of weight that is determined by group consensus.

7. Ranking Options

At this stage, the options are ranked. Thus, the values R , S , Q are sorted in descending order.

8. Select the final option

1) Option (a') was chosen as a compromise solution that has a minimum value of Q in the ranking list, if the following two conditions are satisfied:First condition: credibility rating: Q(a'')-Q(a')≥ DQ where a" option with the second position in the ranking lists is Q and DQ= $1/J - 1$ and J is the number of options. The second condition: Acceptable stability in decision making: Option a' must be in the best shape by R, S be ranked.
2) If the condition is not satisfied, then a set of compromise solutions is proposed, which includes: Options 1 and 2 if the second condition is not satisfied. Variables a' □ a'' □...□a^m if the first condition is not satisfied. a^m is determined with Q(a^m)-Q(a')< DQ respect to m maximum. The best alternative, ranked by Q, Q is an option that has the least amount of.[9]

3.3 AHP[3] Method

AHP method , the method of compensating models. This method is Multi Criteria Decision Method the most widely used tool. AHP For the first time researchers (Thomas – L – saaty) was proposed in 1970.[10] So many uses for this method have been discussed since. Application of AHP is based on three principles: 1) Setting up a structure and format for the class 2) Preferences interact through paired comparisons 3) Establish the logical consistency of measurements.[2]

3.4 Develop Hypotheses And Conceptual Model

Research that by Rangriz, Jalilee and HajiHassani, Performance Evaluation of Iran Cement Companies based on AHP and TOPSIS Methods has been carried out in 2012 as the basis for our work in this paper is intended. In this study, we use VIKOR method with the difference that instead of TOPSIS Method for ranking the cement used.

Hypothesis: liquidity, profitability, activity, financial leverage and growth optimal investment decisions affecting the listed cement companies.In this study, we first calculated the

[3] Analytical Hierarchy Process

growth ratios with sub criteria Sales Growth , Operating Profit Growth , Shareholders Equity Growth , Assets Growth ; profitability ratios with sub criteria Net Profit Margin and Return on Assets ; Liquidity ratios with sub criteria Current , Quick , Cash ; Activity ratios with sub criteria Total Asset Turnover , Working Capital Turnover ; Financial Leverage with sub criteria Debt , Long-term Debts to Shareholder's Equity , Fixed Asset to Shareholder's Equity that The financial information of the cement companies accepted on the Tehran Stock Exchange and Then, for each of the five criteria, the mean of each of the criteria separately obtains and the weight of each criterion through fifty-six questionnaires collected from twenty-eight accepted cement companies are prepared. Questionnaires are completed by financial and investment managers companies. Paired comparisons criteria are in the form of questionnaires. The AHP method is evaluated through a questionnaire and VIKOR method was used in the cement companies are ranked.

4. RESULTS AND DISCUSSION

The AHP method is evaluated through a questionnaire and VIKOR method was used in the cement companies are ranked and The data were obtained from companies financial reports. Cement companies that meet the criteria specified in the decision matrix is shown in Table 1. Scale-out decision matrix will be automatically calculated in Step 1. The weight of each criterion is determined by combining the experts and weighted criteria values in Table 2 have been calculated by using AHP. Next, is determined the maximum and minimum values for each criterion. Results are presented in Table 3. The values of the parameters defined in the previous step and the formula R, S, Q, recent values is calculated for each option. At this stage according to of Q, R, S and consider the index v is calculated the value of Q. according to the Q dependence of the values of v results can be seen in the next step. This step results are given in Table 1. Q parameter is calculated 0.5 based on v.

Table 1. Decision Matrix

	1	2	3	4	5	Q	S	R
1	0. 65	0.42	0.87	0.71	0.34	1.00	2.84	2.39
2	0.38	0.36	0.99	0.64	0.30	0.07	0.69	0.18
3	0.42	0.20	0.86	1.49	0.50	0.05	0.56	0.23
4	0.57	0.40	2.57	0.60	0.33	0.05	0.63	0.14
5	0.25	0.33	0.73	1.90	0.40	0.04	0.53	0.21
6	0.50	0.55	1.93	0.66	0.55	0.00	0.40	0.16
7	0.49	0.41	0.49	0.57	0.31	0.04	0.62	0.16
8	0.54	0.31	4.10	0.65	0.44	0.03	0.55	0.16
9	0.47	0.29	5.43	0.95	0.55	0.05	0.58	0.17
10	0.55	0.52	0.23	0.36	0.41	0.14	0.85	0.37
11	1.16	0.49	2.02	0.39	0.22	0.04	0.54	0.21
12	0.41	0.35	1.48	1.12	0.43	0.03	0.52	0.17
13	0.53	0.38	2.32	0.43	0.28	0.04	0.56	0.17
14	1.25	0.34	1.98	0.35	0.37	0.01	0.47	0.15
15	0.42	0.35	1.48	0.46	0.26	0.07	0.70	0.18

16	0.42	0.25	1.54	0.92	0.20	1.00	0.79	0.22
17	1.00	0.38	2.26	0.68	0.17	0.06	0.59	0.24
18	0.54	0.26	6.30	1.18	0.32	0.05	0.58	0.19
19	1.00	0.27	0.02	0.42	0.22	0.07	0.68	0.21
20	0.28	0.29	0.48	0.90	0.32	0.07	0.71	0.20
21	0.47	0.26	4.05	0.65	0.22	0.08	0.73	0.21
22	0.98	0.40	5.61	0.54	0.33	0.01	0.46	0.14
23	0.88	0.40	8.62	0.40	0.35	0.01	0.45	0.14
24	0.38	0.28	1.74	1.33	0.35	0.06	0.66	0.18
25	0.31	0.27	2.07	1.28	0.33	0.07	0.70	0.18
26	0.61	0.37	2.40	0.69	0.26	0.05	0.62	0.18
27	0.56	0.33	2.44	0.55	0.34	0.04	0.61	0.14
28	0.65	0.30	1.98	0.57	0.28	0.01	0.66	0.17

Table 2. Weights of the main criteria

Rank	Weights	main criteria
3	0.21	Liquidity
5	0.15	Financial Leverage
4	0.16	Activity
2	0.23	Profitability
1	0.24	Growth

According to results are given in Table 2, we see that growth has accounted for the highest weight and the views of decision makers are most important and the criteria of profitability, liquidity and financial leverage, activities are next in priority. Inconsistency are obtained for all values below 0.1 that indicating a high validity.

Table 3. The best and worst of each criterion

Ratio Company	1	2	3	4	5
Best of amount	1.25	0.55	8.62	1.90	0.55
Worst of amount	0.25	0.20	5.43	0.35	0.17

In the next step is to clarify the algorithm, Q in terms of V values have been calculated at between 1-0 and the last step According to the results of our algorithm is not fulfilled the first condition. So which option applies in Q(a^m)-Q(a')< 0.04 will be Superior options set. The result is a set of compromise solutions is proposed. The best option is ranked by Q is an option that has the minimum value of Q. The complete results are given in Table 4.

Table 4. Ranking results based on different values of V

V =0.8		V=0.5		V=0.2	
	Q		Q		Q
Orumie	1.00	Orumie	1.00	Orumie	1.00
Fars and khoozestan	0.17	Dorood	1.00	Fars and khoozestan	0.12
Dorood	0.14	Fars and khoozestan	0.14	Dorood	0.06
Durub	0.12	Durub	0.08	Durub	0.05
Kuroon	0.10	Tehran	0.07	Khazar	0.04
Sefid Neyriz	0.10	Kuroon	0.07	Dashtestan	0.04
Fars	0.10	Sefid Neyriz	0.07	Sefid Neyriz	0.04
Hegmatan	0.10	Fars	0.07	Fars	0.04
Tehran	0.09	Hegmatan	0.07	Tehran	0.03
Bojnoord	0.08	Dashtestan	0.06	Shuhrood	0.03
Khush	0.08	Bojnoord	0.06	Soofian	0.03
Sepahan	0.07	Khazar	0.05	Ghuen	0.03
Soofian	0.07	Sepahan	0.05	Kuroon	0.03
Dashtestan	0.07	Gharb	0.05	Ilum	0.03
Hormozgan	0.07	Ilum	0.05	Bojnoord	0.03
Behbahun	0.07	Hormozgan	0.05	Hegmatan	0.03
Khazar	0.06	Shuhrood	0.04	Hormozgan	0.03
Gharb	0.06	Soofian	0.04	Khush	0.03
Ilum	0.06	Ghuen	0.04	Sepahan	0.02
Shuhrood	0.05	Kermun	0.04	Shargh	0.02
Shargh	0.05	Behbahun	0.04	Gharb	0.02
Ghuen	0.05	Shargh	0.03	Muzandarun	0.02
Kermun	0.05	Muzandarun	0.03	Kermun	0.02
Muzandarun	0.04	Kordestun	0.01	Behbahun	0.02
Kordestun	0.02	Esfehan	0.01	Shomal	0.01
Esfehan	0.02	Khush	0.01	Kordestun	0.00
Ardabil and Ahak Azar shahr	0.02	Ardabil and Ahak Azar shahr	0.01	Esfehan	0.00
Shomal	0.00	Shomal	0.00	Ardabil and Ahak Azar shahr	0.00

According to the results presented in Table 4, we see that Shomal Cement company in high agreement, Ardabil and Ahak Azar shahr, Esfehan and Kordestan as the best options were selected as the best option. The average the terms of the agreement set Cement Companies of Shomal, Ardabil and lime Azar shahr, Khush, Esfehan, Kordestan, Mazandaran and Shargh Cement Companies are the best investment options. Down the terms of the agreement set Cement Companies Ardabil and lime Azar shahr Azar Shahr, Esfehan, Kordestan, Shomal, Behbahan, Kerman, Mazandaran, Gharb, Shargh, Sepahan, Khush, Hormozgan, Hegmatan, Bojnourd, Ilum, Caroon, Ghuen, Soofian, shahroud and Tehran were selected as the best option. Thus, liquidity, profitability, activity, financial leverage and growth optimal investment decisions affecting the accepted in Stock Exchange cement companies and the influence of rating companies and research hypothesis is not reject.

5. CONCLUSION

The study concluded that the average agreement terms set Cement Companies of Shomal, Ardabil and lime Azar shahr, Khush, Esfehan, Kordestan, Mazandaran and Shargh Cement Companies are the best investment options and liquidity, profitability, activity, financial leverage and growth optimal investment decisions affecting the accepted in Stock Exchange cement companies. We compared the results of this research and baseline research see that Ardabil and lime Azar shahr Cement Company in the previous study had ranked first among companies to account and In this study, could also be part of the top companies. It is recommended that the names among top companies aren't your weaknesses are identified and resolved. It is suggested that in future studies the results obtained with other techniques such as SAW, ELEKTRE, PROMETHEE solution and compared. It is suggested that the field of research, to provide guidelines for the implementation in companies and the result is obtained. Incomplete information about company Cement headquarters address of each company's website and a lack of information is on the limitations of this study.

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