



**Analysis of Financial Performance of Cement Industry  
Manufacturing Companies in Tehran Stock Exchange Using the  
FAHP Technique and the TOPSIS Method**

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**ABSTRACT**

**Objective:** The aim of this study was to provide a fuzzy model for evaluating the performance of cement industry manufacturing companies listed in Tehran Stock Exchange in 2013, 2014 and 2015 using financial ratios and considering the preferences of different decision makers.

**Methodology:** This study was based on FAHP and TOPSIS, in which the FAHP was used to determine the weight of different criteria of the decision makers. Finally, the cement industry companies were ranked using the TOPSIS approach. In this study, different financial ratios such as liquidity ratios, leverage ratios, activity ratios, profitability ratios, and growth ratios were used for evaluation.

**Results & Findings:** Eleven findings and nineteen results were presented that three Soufian Cement Company, Ghadir Capital and Industry Development Cement Company, and Hegmatan Cement Company from Three East Azarbaijan, Tehran, and Hamedan provinces and from three different geographic regions of Iran have had the most similarity with the ideal solution in the



ranking of options (alternatives) by the TOPSIS method. Also, in the light of core values and by maintaining their market share and competent corporate governance, they have gained the highest output of the cement industry by obtaining the first rank respectively in 2013, 2014, and 2015, which, in turn, can be a good representative of the country's cement industry. By modeling the top companies and with the help of science along with analyzes in other sectors of the cement industry, the firms with weaker performance can strengthen their performance. This can become a strong strength for the Iranian cement industry.

**Keywords:** Performance measurement, Financial Ratios, Cement Industry, FAHP, TOPSIS

## 1. INTRODUCTION

The corporate performance measurement has long been considered as an important issue. Measurement the companies' performance is nowadays one of the most important financial issues for them. Using the corporate performance evaluation methods, the issues such as the following can be addressed appropriately (BACIDORE, 1997):

- How much the companies have struggled to raise the interests of their shareholders?
- What indicators are considered by banks and credit institutes in providing facilities to the companies?
- What aspects are considered by the owners of the companies in giving rewards to the managers?
- Ultimately, what points are considered by the government entities due to legal requirements in relation to companies?

Most economics scholars have recognized capital formation as the most important factor for economic development. Economic development in today's progressive world is owed to stock markets and capital market activities (GHALIZADEH; HASSAN, 2004).

The investors are always looking for the best investment to gain further interest. To this end, they seek to separate successful and unsuccessful companies and rank them. Considering the poor performance of ranking methods used in

Tehran Stock Exchange, it appears crucial to provide a method that can facilitate the issue meanwhile being highly reliable. Making decisions by considering a number of criteria, each of which has a special place, can be possible only by using multi-criteria decision-making models. Various indicators tailored to the type of ranking are used in these methods (IRAQI, 2008).

Therefore, financial evaluation and ranking the companies can be done by considering financial ratios as indicators, Stock Exchange companies as options and the use of multi-criteria decision-making methods. The aim of this research was to provide a decision-making model to investigate and evaluate the financial performance of the stock market companies by using their financial ratios and also to achieve the decision makers' thematic judgments.

To do so, a combined method (Fuzzy Analytical Hierarchical Process (FAHP) and TOPSIS) was used. These two methods are recognized as the most important and most widely used decision-making methods and their combination is expected to deliver optimal results. Nowadays, following the competitiveness of the global economy and increased public awareness of financial and investment issues, the capital market has drawn the attention more than ever.

On the other hand, to capture the attention of investors, most companies are trying to produce high quality goods and services with lower costs. Meanwhile, a number of companies try to show a favorable image of their company status by providing unrealistic and misleading information to keep themselves at the competition scene in attracting the investors. Hence, measuring the performance of companies with appropriate and diverse indicators as well as rating them based on these indices seem to be important and beneficial to the investors.

The performance appraisal with respect to the development of capital markets is among the major issues regarded by the stakeholders, creditors, governments and managers. The investors always tend to be informed of the success of managers in using their capitals (MAHMOOD; SHAHABDIN; JAFAR, 2010). Financial ratios are the most useful indicator for the performance and the financial status of the company (IRFAN; NILSEN, 2007).

However, ranking by considering several criteria that each have a special place only can occur by applying the multi-criteria decision-making models. Various

indicators are used tailored to the type of ranking in these methods (MASOUMEH; ZERR, 2009). Hence, using five financial ratios as indicators and employing the multi-criteria decision making methods, we can financially evaluate and rate the companies listed on the Stock Exchange. Accurate assessment of companies in the industries can be a full mirror of the status of different companies compared to their competitors, revealing their internal strengths and weaknesses as well as their external opportunities and threats (KASHAN, et al. 2004).

The evaluation of companies plays a major role in the industry. Introducing industry-leading companies specifies their position in a competitive environment based on various indicators or variables. This, on the one hand, makes the weak companies to distinguish their distance from the top ones to develop an appropriate strategy to reach them. On the other hand, the top companies will strengthen their superiority by defining their proper plans and strategies.

The capital formation is assumed the most important factor in economic development from the perspective of most economic thinkers and stock and capital market is one of the most important sources of providing capital. The total of these factors leads to increased competition in the market, and increasing competition will also ultimately leads to the development of the society (MAHMOUD, et al. 2006).

Financial information is one of the most important factors in most decision makings. More complex decision-making environment with higher uncertainty will add the difficulties of the decision-making process. In this regard, the financial statements are designed to help users identify the key relationships and predictions and investors use such information to evaluate the investment decisions and prioritize them (SASAN; KAVEH; GHOLAMREZA, 2004).

In such an environment, an absence of criteria and methods for evaluating companies and helping the investors in the Tehran Stock Exchange cannot be ignored. There is also a void of methods to help the companies listed on the Tehran Stock Exchange to know what a score they need to obtain for getting more efficient and closing to the level of efficiency.

## **2. RESEARCH LITERATURE AND BACKGROUND**

Investing in stocks seems to be one of the most important factors by using which a country can be developed. Investment in equity can achieve the

predetermined target if it has been done properly and optimally. To this end, appropriate models need are needed for measurement of stock efficiency or productivity. There are several different models in this regard, including Fuzzy Analytical Hierarchical Process (FAHP) and TOPSIS.

Using this technique, the success rate of a share can be measured at a time section; however, the performance measurement at a time section is not sustainable enough according to environmental, social and economic conditions. On the other hand, if there is a model to be used to measure the stocks growth (regression) in several periods, a proper context will be provided for the investors' decision making.

Given that the cement industry is one of the influential industries of Tehran Stock Exchange with many member companies, we designed this research to evaluate and rank the companies of the cement industry listed in Tehran Stock Exchange using the combined method (FAHP & Topsis).

Cement industry plays a highly important role in promoting the country's development goals as a strategic commodity and is of particular importance as one of the conversion industries in Iran. It has been also considered in the path of self-reliance In terms of currency savings. Hence, economical measurement and comparison of active units in this industry within the country appears to be important and considerable in terms of efficiency and productivity with a managerial attitude.

Currently, 5 cement companies are operating in Iran and the number of units increases annually. The main advantage of this research is to compare these units with each other meanwhile evaluating their efficiency. In addition to illustrating the distribution of the functional structure of the cement industry within the country, this domestic comparison also compares each unit with the whole domestic units; thus, units operating in a similar political-economic structure are compared with each other.

Using the FAHP, TOPSIS approach, we tried to identify the major cement production units inside the country and compare their efficiencies. Accordingly, we could separate more efficient units and compare them meanwhile considering the specific power of each unit. With the help of this analysis, we would be able eventually help the decision makers change the efficiency elements of each unit to move toward higher levels of efficiency. Also, using the FAHP -TOPSIS approach,

the companies can be assessed with the aim to maximize profits by considering the composition and optimal allocation of resources.

A brief explanation of some multi-criteria decision-making methods is provided for the reader to clarify the two methods of hierarchical process and topsisization and other multi-criteria multi-criteria methods.

## 2.1. SAW

A simple weighting model is one of the easiest methods for multi-index decision making. By calculating the weights of indicators, it is easy to use this method. The steps to use this method are as follows:

- Decrease the decision matrix
- Non-linear scaling of decision matrix values
- Multiplication of non-scale matrices in weights of indicators
- Choose the best option using the countermeasure criterion:

$$A^* = \left\{ A_i \mid \text{Max} \sum_{j=1}^n n_j w_j \right\}$$

## 2.2. ELECTRE

This model was introduced in the late 1980s and was considered as one of the best multi-indicator decision-making techniques. The basis of this concept is "non-ranked relationships", which does not necessarily lead to ranking of options, but may also eliminate options.

## 2.3. TOPSIS

This model was proposed by Huang and Yun in 1981 and is one of the best multi-index decision-making models. This technique is based on the notion that the choice option should have the least distance with the ideal ideal solution (best possible) and the maximum distance with the ideal negative solution (the worst possible condition).

The problem solving steps using this method are:

- Calculation of soft-scale non-scale matrix
- Compute the weights matrix with one of the weighing methods W

- Calculation of V-Scale Non-scale Matrix
- Ideal positive solution  $V_j^+$ : the largest value for the positive indicators and the smallest value for the negative index. In other words, we compile the vector of the best values for each index.
- Ideal negative solution  $V_j^-$ : the largest value for negative indicators and the smallest value for positive indicators. In other words, we compose the vector of the worst values for each index.
- Calculates the Euclidean distance of each option to positive and negative ideals.

$$d_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2}, \quad i=1,2,\dots,m$$

$$d_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2}, \quad i=1,2,\dots,m$$

- Determine the relative proximity of an option to the ideal solution:

$$CL_i^* = \frac{d_i^-}{d_i^- + d_i^+}$$

- Ranking options based on larger CL.

## 2.4. Analytical hierarchy process

Hierarchical Analytic Process (AHP) is one of the most well-known multi-dimensional decision-making techniques developed by Thomas A. Lee in the 1970s (Haynes, et al. 1993). This method is used when decision-making practice with multiple options. And the decision maker is useful, indexes can be quantitative or qualitative, the basis of this method lies in the comparison of the pair.

Wang (2008) used Gray Relations Analysis method in categorizing financial ratios to assess the financial performance of the airlines in Taiwan and employed the fuzzy multi-criteria decision making in the final ranking of these companies (WANG, 2008). Oortagul and Karakasoglu used the FAHP and TOPSIS to evaluate the financial performance. They used the first method to determine the weights of the studied financial ratios.

Then, using these weights and the second method, they ranked 15 companies active in the Turkish cement industry (WANG, 2008). By combining the FAHP and TOPSIS methods, Wang (2008) initially determined the importance of decision-making criteria and finally ranked the suppliers by employing the fuzzy TOPSIS approach.

Using the FAHP, Kuo, Yang and Huang (2008) evaluated the performance of the Turkish cement industry companies and employed the TOPSIS approach to rank the studied companies. Rezaie, et al. (2014) ranked the Cement companies active in the stock market during the two consecutive years of 2008 and 2009 using the financial ratios and utilizing the Integrated Fuzzy Analytical Hierarchical Process and Vikor method. Based on the results obtained in 2008, the companies of Qaen, Fars and Khuzestan had the best performance, respectively.

In 2009, the companies of Hormozgan, Ardebil and Qaen had respectively the best performance (REZAIE, et al., 2014). Chang, et al. (2010) ranked the cement companies active in the stock market using the financial ratios and Analytical Hierarchy Process and Topsis methods. According to their results, the cement companies of Fars, Ardebil and Qaen obtained the first to third ranks of financial performance, respectively (MASOUMEH; ZERR, 2009).

In another research, Yalcin, Bayrakdaroglu and Kahraman (2012) evaluated the performance of the Turkish banking sector. Considering a variety of financial ratios in this study, they initially extracted the weights of ratios using the FAHP approach. Then, the banks were ranked by TOPSIS method. They showed that the banks more successful in practice had obtained better rating in this study as well (YALCIN; BAYRAKDAROGLU; KAHRAMAN, 2012).

In a research entitled as "Evaluation of the performance of joint venture capital investment firms using the developed TOPSIS method with a different distance approach", Chang et al. evaluated the performance of joint venture funds in the structure of multi-index planning analysis (2010) using the Treynor ratio, Sharpe ratio, Jensen alpha and the ratio of information, and each of these criteria was also used for the final ranking. In this study, 82 joint investment funds in Taiwan were evaluated for 34 consecutive months by using the TOPSIS method (CHANG; LIN; LIN; CHIANG, 2010).

Using the FAHP, TOPSIS & VIKOR approaches, Ho, Cheung and Cheung, (2009) ranked three reputable banks of Taiwan based on the Balanced Scorecard



method and showed that the methods of fuzzy decision making models are suitable methods for performance evaluation (HO; CHEUNG; CHEUNG, 2009).

Using the FAHP & TOPSIS methods, Mahmood, Shahabdin and Jafar (2010) ranked 5 credible banks in Turkey and acknowledged that the non-financial criteria should also be considered along with financial criteria to evaluate the performance. Masoumeh and Zerr (2009) provided a fuzzy model for evaluating the performance of Turkish cement companies using the developed financial ratios, an approach based on the FAHP and TOPSIS methods (MASOUMEH; ZERR, 2009).

In a research entitled as "The use of Gray Relations Analysis to solve the problems of multi-criteria decision making", Wang (2008) described this model. In this study, two case studies were solved by Gray Relationship Analysis method and the resulting answers were compared with the answers obtained from solving these problems by data envelopment analysis, TOPSIS and the simple total weight methods. The ranking of options by Gray Relationship Analysis method is more similar to the results obtained by the TOPSIS and the Simple Harmonic Mean methods (KUO; YANG; HUANG, 2008).

### **3. RESEARCH METHODOLOGY**

#### **3.1. Type of research**

As the subject of this research was related to the present time in terms of time section and we sought to acquire a better and more comprehensive understanding of the status quo by gathering data and information about the current situation, the research methodology could be seen as a surveying one. In terms of objective it was a descriptive of an applied type. Regarding the research design, it could be categorized as a post-event research. Since this research was aimed at assessing the financial performance of the entire cement manufacturing industry companies listed in the stock exchange using FAHP and TOPSIS methods, then, no hypothesis was presented.

#### **3.2. Research Methodology**

In terms of information gathering method, for the introduction and background of the research, reliance on library studies and the study of previous research in the field is studied, and then data collection to determine the coefficients of preferences of criteria from the pairwise comparison of the hierarchical process of fuzzy

questionnaire, which is between 20 experts Includes financial professors and stock brokers and financial experts who downloaded the data from the questionnaire using online bukletti software, weighted financial ratios and raw data from the cement producing companies in the stock exchange from the site. Online Stocks Organization Securities Iraq, Iran Capital Market Information Center, site analysis of financial data and collecting new RhAVrd software is used.

### **3.3. Data validity**

The validity implies that the measurement tool can measure the examined attribute and not another attribute. Thus, one of the main goals in designing any test or questionnaire is its high validity. In this research, due to the use of standard variables extracted from various articles, the research variables benefited from content validity.

### **3.4. Data reliability**

In this research, the reliability of questionnaires was measured using the matrices inconsistency rate. Based on the experience, the inconsistency rate lower than 0.1 indicates the validity of comparisons; otherwise, the comparisons should be revised (MEHREGAN, 2014). Reliability also refers to the stability of the research findings. Thus, a measurement tool is valid if the measurement results of an attribute by the same tool under the same conditions would be similar to the previous measurement (ZOHREH; ABBAS, 2005). The inconsistency rates obtained for all the comparisons in this study were less than 0.1, which indicates the validity of the questionnaire.

### **3.5. Target population**

The statistical population of this research included all the cement industry companies listed in in Tehran Stock Exchange, which covered all cement companies that were active from the beginning of 2013 to the end of 2015.

### **3.6. Sample community: The method and reason for choosing the sample community**

The sampling methods were not used and we employed a screening model to select the cement companies. Thus, the companies from the statistical community with necessary and sufficient information were selected and the rest were excluded.



### 3.7. Data Analysis

After collecting data, a new phase of the research process, known as the data analysis stage, was begun. Certainly, all the issues discussed in the previous section would matter if the information and data gathered are analyzed accurately and properly and the results of data analysis are properly interpreted. In this section, according to the research methodology, the results of the questionnaires, data analysis, and the paired comparisons of matrices were presented using the Macro Excel software.

After evaluating the questionnaires completed by the experts (financial experts and stockholders active in the stock exchange), the consistency rate of the pairwise comparisons of matrices was calculated, which was lower than 0.1 for each of the matrices, revealing the consistency of the comparisons. Then, the criteria evaluated in this research were weighted using the FAHP method and ranked by the TOPSIS method with the Online Buckley software. The logic principle of this model defines the ideal positive solution and the ideal negative solution. The ideal solution (positive) is a solution that increases the profit criterion and reduces the cost criterion.

The optimal option is the one with the smallest distance from the ideal positive solution and the farthest distance from the ideal negative solution at the same time. In other words, in the ranking of options by TOPSIS method, the options with the highest similarity to the ideal solution will get a higher rank. Figure (1) shows the research model, while Table 1 provides the weights of main criteria and the sub-criteria.

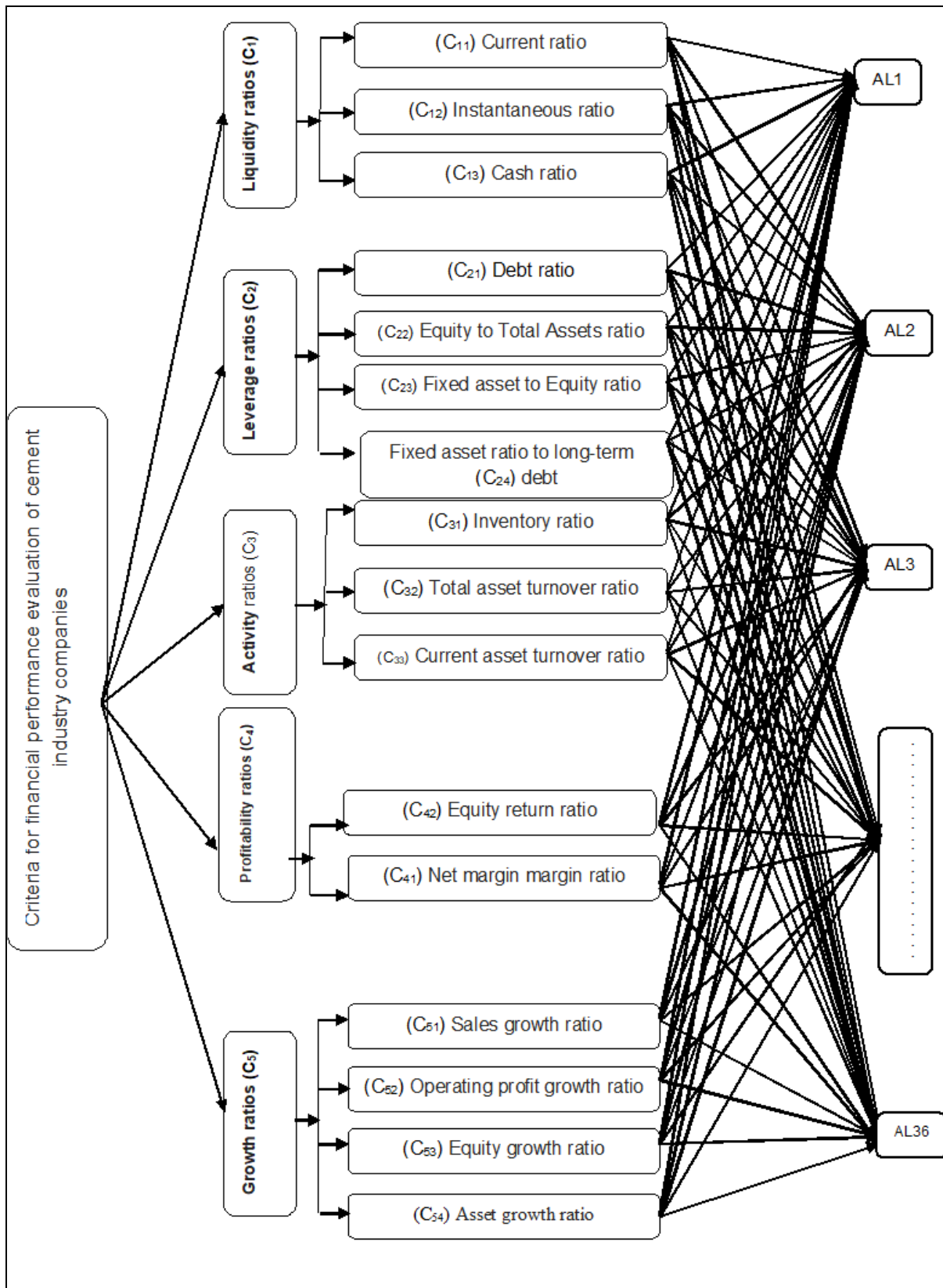


Figure 1: Hierarchical decision making structure using target levels, benchmarks and options

**Table 1: provides the weights of main criteria and the sub-criteria**

main criteria	weight of the main criteria	sub criteria	Weight of sub criteria	Criteria weight ranking
Liquidity ratios (C <sub>1</sub> )	0 /13	Current ratio) C <sub>11</sub> (	0 /021	16
		Instantaneous ratio )C <sub>12</sub> (	0 /055	8
		Cash ratio) C <sub>13</sub> (	0 /047	10
Leverage ratios (C <sub>2</sub> )	0 /239	Debt ratio) C <sub>21</sub> (	0 /055	9
		Equity to Total Assets ratio) C <sub>22</sub> (	0 /059	5
		Fixed asset to Equity ratio) C <sub>23</sub> (	0 /065	4
		Fixed asset ratio to long-term debt) C <sub>24</sub> (	0 /045	11
Activity ratios (C <sub>3</sub> )	0/ 136	Inventory ratio) C <sub>31</sub> (	0 /031	15
		Total asset turnover ratio) C <sub>32</sub> (	0 /059	7
		Current asset turnover ratio) C <sub>33</sub> (	0 /036	14
Profitability ratios (C <sub>4</sub> )	0/ 324	Net margin margin ratio) C <sub>41</sub> (	0 /136	2
		Equity return ratio )C <sub>42</sub> (	0 /171	1
Growth ratios (C <sub>5</sub> )	0 /233	Sales growth ratio )C <sub>51</sub> (	0 /059	6
		Operating profit growth ratio) C <sub>52</sub> (	0 /092	3
		Equity growth ratio )C <sub>53</sub> (	0 /037	13
		Asset growth ratio )C <sub>54</sub> (	0 /043	12

As you can see in Table 1, the weights of the main criteria and the sub-criteria show that the profit ratios and liquidity ratios with the lowest weights are 0.324 and 0.13, which indicates that the profit ratios The effect of measuring the effect of cement companies on liquidity ratios has the least effect on the measurement of cement companies. Among the sub-criteria, the return on shareholders' equity is related to the profit margin of 0.171 with the highest impact and current trend related The ratio of liquidity to 0.021 has a lower impact on the measurement of cement producing companies in the stock exchange.

The results of evaluation of financial performance of cement industry companies using topsis method are as follows:

Table 2: production companies ranked one and two and three in 2013

Ranking (2015)	Ranking (2014)	Ranking (2013)	Ci (2015)	Ci (2014)	Ci (2013)	Options
20	6	18	0/4465	0/5628	0/4756	Behbahan Cement
29	34	20	0/4221	0/4846	0/4418	Bojnord cement
25	21	9	0/4322	0/5013	0/5392	Darab cement
11	20	15	0/4589	0/5014	0/4983	Dashtestan Cement
14	5	14	0/4545	0/5640	0/5106	Isfahan cement
22	14	24	0/4423	0/5342	0/4343	Ilam Cement
13	18	34	0/4564	0/5184	0/2734	Fars new cement
10	15	32	0/4602	0/5275	0/3418	Fars cement
36	4	35	0/2984	0/5651	0/2702	Qaen Cement
27	25	21	0/4254	0/4980	0/4401	Garb cement
1	24	17	0/5129	0/4991	0/4857	Hegmatan Cement
35	19	7	0/3784	0/5114	0/5464	Hormozgan Cement
15	26	5	0/4534	0/4972	0/5557	shomal cement
24	27	26	0/4384	0/4927	0/4215	khazar cement
34	22	29	0/4096	0/5010	0/3868	Kerman Cement
23	13	2	0/4399	0/5381	0/5892	Khash Cement
33	8	12	0/4109	0/5587	0/5164	Kurdistan Cement
32	33	8	0/4165	0/4847	0/5419	Karoon cement
7	10	11	0/4708	0/5463	0/5259	Mazandaran Cement
21	28	25	0/4445	0/4921	0/4300	Shahrood Cement
6	32	23	0/4754	0/4858	0/43645	Sepahan cement
28	3	6	0/4251	0/5819	0/5494	Sharg cement
26	12	30	0/4276	0/5387	0/3670	Sefid nay riz cement
8	30	1	0/4622	0/4878	0/5911	Sufi cement
16	16	4	0/4493	0/5229	0/5604	Tehran cement
18	29	10	0/4479	0/4914	0/5316	Urmia Cement
9	36	13	0/4612	0/4666	0/5113	Bageran Cemen
2	17	22	0/5127	0/5207	0/4397	Larsabsevar Cement
4	2	31	0/5039	0/5957	0/3575	Larestan cement
12	7	27	0/4566	0/5609	0/4038	Majd Khaf Cement
3	23	33	0/5042	0/4996	0/2846	Momtazan Kerman cement
19	35	28	0/4478	0/4683	0/3976	Khorramabad Cement
5	11	36	0/4828	0/5456	0/2306	Drood cement
31	1	19	0/4169	0/6361	0/4438	Toseye sarmaye and sanate ghader cement
30	31	16	0/4188	0/4859	0/4914	Khuzestan Cement
17	9	3	0/4481	0/5563	0/5833	Arta Ardabil Cement

Table 2 shows Sufian Cement, Khash, and Artavirbil production companies ranked one and two and three in 2013, respectively, indicating that the three



companies had the highest financial performance in 2013 and had a profitable profit. have been.

Ghadir, Larestan and East Cement Industries Development Cement Companies ranked one and two and three in 2014, respectively, indicating that these three companies had the highest financial performance in 2014 and profitable Have been huge.

Hegmatan, Larsbevshire, and Momtazan Cement manufacturing companies ranked one and two dozen in 2015 respectively, indicating that the three companies had the highest financial performance in 2015 and had high profits. have been.

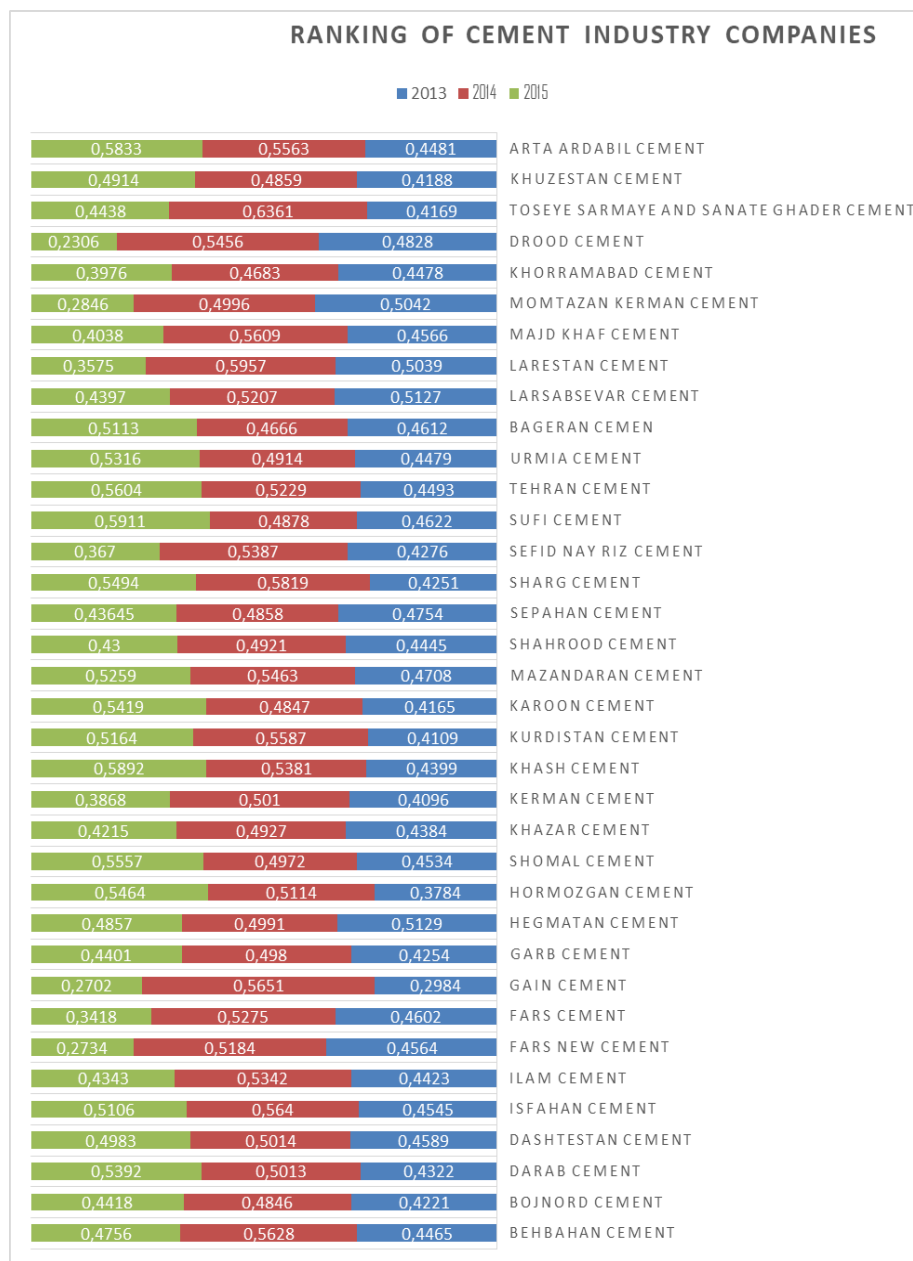


Figure 2: the financial performance of cement companies

In Figure 2, the financial performance of cement companies clearly shows in three years, 2013,2014 and 2015, with three colors of green and blue, respectively.

Table 3: Average 3 years, 2013, 2014 and 2015

Ratings are based on an average of 3 years (2013.2014.2015)	Average 3 years (2013.2014.2015)	Options
12	0/028924337	Behbahan Cement
28	0/026345903	Bojnord cement
13	0/028826566	Darab cement
16	0/028557922	Dashtestan Cement
7	0/02982368	Isfahan cement
22	0/027491098	Ilam Cement
35	0/024399985	Fars new cement
30	0/025865186	Fars cement
36	0/021710072	Qaen Cement
26	0/026617269	Garb cement
9	0/029384253	Hegmatan Cement
20	0/028035347	Hormozgan Cement
8	0/029533442	shomal cement
27	0/026417124	khazar cement
32	0/025259653	Kerman Cement
2	0/030659472	Khash Cement
11	0/028940578	Kurdistan Cement
18	0/028264922	Karoon cement
5	0/030161007	Mazandaran Cement
25	0/026704673	Shahrood Cement
23	0/027319566	Sepahan cement
4	0/03016777	Sharg cement
29	0/025899616	Sefid nay riz cement
3	0/030272158	Sufi cement
6	0/03000057	Tehran cement
14	0/028827423	Urmia Cement
19	0/028252452	Bageran Cemen
15	0/028826566	Larsabsevar Cement
17	0/028303203	Larestan cement
21	0/027643651	Majd Khaf Cement
33	0/025125855	Momtazan Kerman cement
31	0/025694373	Khorramabad Cement
34	0/024399985	Drood cement
10	0/028962781	Toseye sarmaye and sanate ghader cement
24	0/027309951	Khuzestan Cement
1	0/03130981	Arta Ardabil Cement



Table3 shows the average cement manufacturing companies for the three consecutive years of 2013, 2014 and 2015, which ranked Artha, Ardebil, Khash and Sufian companies, respectively.

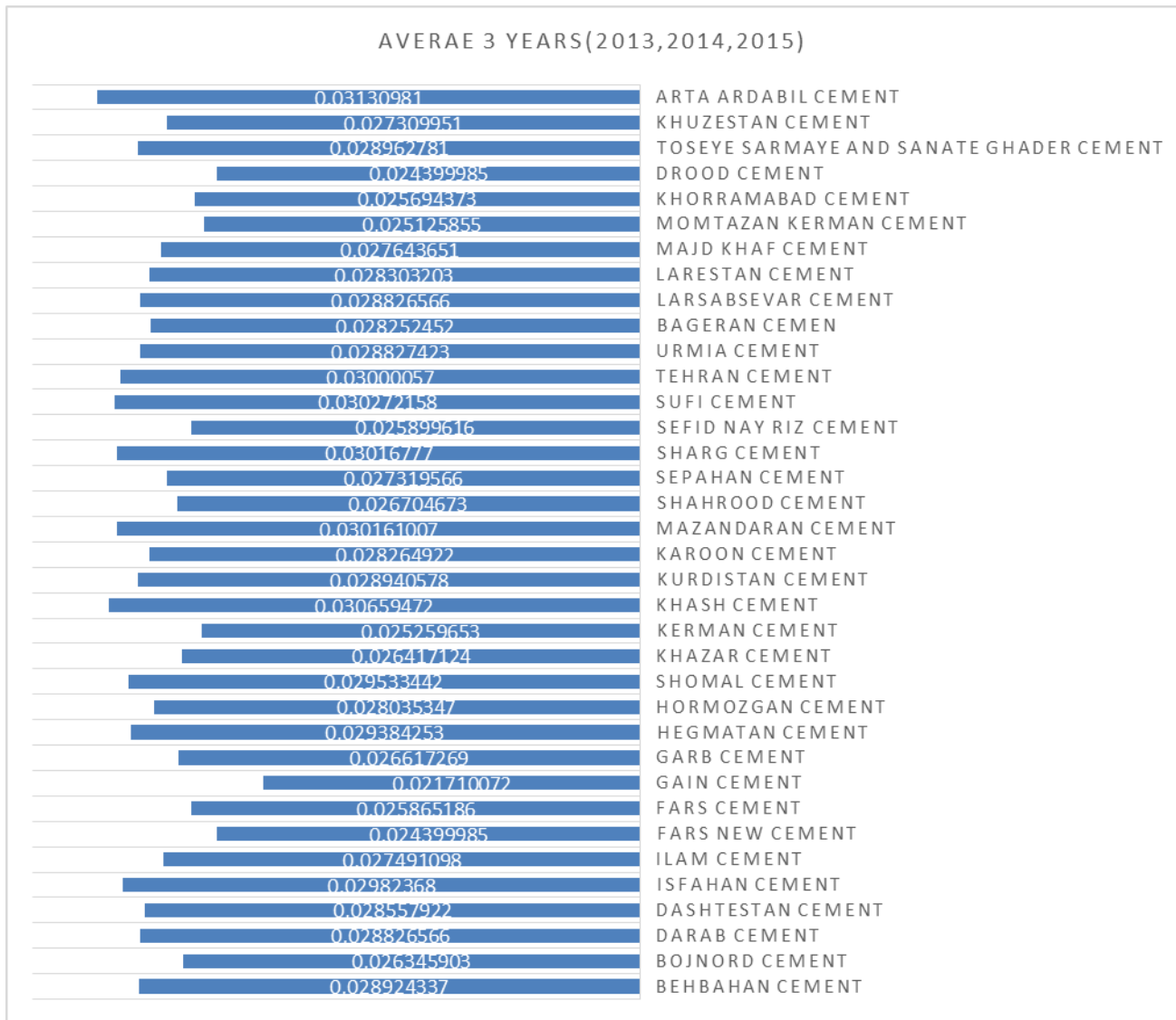


Figure 3: shows the average cement manufacturing industry

Figure 3 shows the average cement manufacturing industry for the three consecutive years of 2013, 2014 and 2015.

### 3.8. Research Findings

As seen in Table (2) and Figure (1), the cement manufacturing companies listed in Tehran Stock Exchange were ranked using the TOPSIS method with the following findings:

Finding 1: Soufian Cement Company, with the closeness ratio of 0.5911, was ranked the first with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2013. In other words, in the ranking of options by TOPSIS method, the options with the highest similarity to the ideal solution will earn a higher rating.

Finding 2: Khash Cement Company, with the closeness ratio of 0.5892, was ranked the second with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2013.

Finding 3: Arta Ardebil Cement Company, with the closeness ratio of 0.5833, was ranked the third with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2013.

Finding 4: Ghadir Capital and Industry Development Cement Company, with the closeness ratio of 0.6361, was ranked the first with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2014.

Finding 5: Larestan Cement Company, with the closeness ratio of 0.5957, was ranked the second with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2014.

Finding 6: Shargh (East) Cement Company, with the closeness ratio of 0.5819, was ranked the third with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2014.

Finding 7: Hegmatan Cement Company, with the closeness ratio of 0.5129, was ranked the first with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2015.

Finding 8: Lar Sabzevar Cement Company, with the closeness ratio of 0.5127, was ranked the second with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2015.

Finding 9: Momtazan Kerman Cement Company, with the closeness ratio of 0.5042, was ranked the third with simultaneously the minimum distance from the ideal solution and the farthest distance from the ideal negative solution in 2015.

Finding 10: Soufian Cement Company, Ghadir Capital and Industry Development Cement Company, and Hegmatan Cement Company were ranked the first respectively in 2013, 2014 and 2015.

Table 3 and Figure 2 show the average of three years (2013, 2014 and 2015), based on which:

Finding 11: Arta Ardebil Cement Company, Khash Cement Company, and Soufian Cement Company were ranked the first, the second, and the third, respectively.

#### **4. DISCUSSION & CONCLUSION**

Performance measurement and evaluation has drawn the attention of man from the very past. The aim of performance assessment is to identify weaknesses and strengths, and consequently modify, improve, and promote the performance. Nowadays, given the increasing growth and importance of organizations in the community, the evaluation of the performance of organizations and managers has come to focus of attention and various indicators have been introduced as the criteria measurement of the organizations' performance.

Productivity, efficiency, and effectiveness are examples of these assessment criteria. Performance appraisal is not limited to the individuals' evaluation, but any system or organization can be evaluated based on their goals to measure their success rate in achieving those objectives.

In this regard, the assessment of the companies listed in the capital market (stock market) is of particular importance since it has a crucial impact in guiding the investors to choose stocks on one hand, and also helping the managers to identify the current status of the company and taking measures to prevent the crisis as well as initiatives for productivity growth on the other hand. It is especially essential for industries such as the cement industry, which is considered among the strategic industries.

Therefore, sufficient care should be made in choosing the best method from different methods of evaluating the performance of companies. In this regard, given the advantages of the TOPSIS method, the cement industry companies were compared in different years with the same industry companies and ranked by the proposed model. Unlike other studies, we used the Fuzzy Analytical Hierarchical

Process Method in this study to reduce uncertainty and ambiguity in this study. We also employed the TOPSIS approach to rank companies.

In addition, since the weights used were obtained by groups that besides benefiting from academic knowledge had practical experience in the field of investment, training of credit and investment providing methods and were also well familiar with Tehran Stock Exchange environment, the methodology had a relative validity, which is another feature of this study. The results obtained from this study were as follows:

Conclusion 1: Three Soufian, Khash, and Arta Ardebil Cement Companies from three provinces of East Azarbaijan, Sistan and Baluchestan, and Ardebil, which have different geographical area and climatic conditions, have had the best performance in 2013. Thus, one can say that they have earned the highest profit in this year.

Conclusion 2: Three Tehran, Shomal (North), and Shargh (East) Cement Companies from Tehran Province, which have the same geographical area and climatic conditions, have had a better performance in the second place in 2013.

Conclusion 3: Three Ghadir Capital and Industry Development, Larestan, and Shargh (East) Cement Companies from three provinces of Tehran, Fars, and Tehran, which have different geographical area and climatic conditions, have had the best performance in 2014. Thus, one can say that they have earned the highest profit in this year.

Conclusion 4: Three Qaen, Isfahan, and Behbahan Cement Companies from three provinces of South Khorasan, Isfahan, and Khuzestan, which have different geographical area and climatic conditions, have had a better performance in the second place in 2014.

Conclusion 5: Three Hegmatan, Lar Sabzevar, and Momtazan Kerman Cement Companies from three provinces of Hamedan, South Khorasan, and Kerman, which have different geographical area and climatic conditions, have had the best performance in 2015. Thus, one can say that they have earned the highest profit in this year.

Conclusion 6: Three Larestan, Dorood, and Sepahan Cement Companies from three provinces of Fars, Lorestan, and Isfahan, which have different

geographical area and climatic conditions, have had a better performance in the second place in 2015.

Conclusion 7: Three Fars Nou, Qaen, and Dorood Cement Companies from three provinces of Shiraz, South Khorasan, and Lorestan, which have different geographical area and climatic conditions, have had the weakest performance in 2013 and have earned a very little profit in this year.

Conclusion 8: Three Bojnourd, Khorramabad, and Bagheran Cement Companies from three provinces of North Khorasan, Lorestan, and Isfahan, which have different geographical area and climatic conditions, have had the weakest performance in 2014 and have earned a very little profit in this year.

Conclusion 9: Three Kerman, Hormozgan, and Qaen Cement Companies from three provinces of Kerman, Hormozgan, and South Khorasan, which have different geographical area and climatic conditions, have had the weakest performance in 2015 and have earned a very lower profit in this year.

Conclusion 10: Three Behbahan, Ghadir Capital and Industry Development, and Bojnourd Cement Companies from three provinces of Khuzestan, Tehran, and North Khorasan, which have different geographical area and climatic conditions, have had a modest performance in 2013.

Conclusion 11: Three Fars Nou, Hormozgan, and Dashtestan Cement Companies from three provinces of Shiraz, Hormozgan, and Bushehr, which have different geographical area and climatic conditions, have had a modest performance in 2014.

Conclusion 12: Three Urmia, Khorramabad, and Behbahan Cement Companies from three provinces of West Azarbaijan, Lorestan, and Khuzestan, which have different geographical area and climatic conditions, have had a modest performance in 2015.

Conclusion 13: Out of 36 manufacturing companies in the cement industry, Soufian Cement Company has had the best performance in 2013, 2014, and 2015 with a closeness ratio of 0.036, which has gained the highest most profits and market share.

## **5. BASED ON THE RESEARCH LITERATURE AND BACKGROUND**

Conclusion 13: Danesh Shakib and Fazli ranked the cement companies active in the stock industry using the financial ratios and employing the Analytical Hierarchy Process and TOPSIS methods in 2009. Based on the results of this research, Fars, Ardebil and Qaen cement companies obtained the first to third rankings of financial performance respectively.

In comparison with the current research, in which the financial performance of the manufacturing companies of the cement industry in Tehran Stock Exchange was assessed using the FAHP and TOPSIS methods for 3 years of 2013, 2014, and 2015, the average of these 3 years shows that the Arta Ardebil Cement Company, Khash Cement Company, and Soufian Cement Company have been ranked the first, the second, and the third, respectively.

Conclusion 15: Rezaei, Saeedi Ramiani, Nazari Shirkoohi and Badizadeh (2014) ranked the Cement companies active in the stock market using the financial ratios and utilizing the Integrated Fuzzy Analytical Hierarchical Process and Vikor method during the two consecutive years of 2008 and 2009.

Based on the results obtained in 2008, the companies of Qaen, Fars and Khuzestan had the best performance, respectively. In 2009, the companies of Hormozgan, Ardebil and Qaen had respectively the best performance. As a result, Arta Ardebil Cement Company has a better financial performance than other companies in the cement industry.

Conclusion 16: In the proposed approach, the mental judgments of decision makers in the paired comparison process and financial tables of companies were used in the performance appraisal. The proposed decision making model was used to rank the cement industry companies in Tehran Stock Exchange. Through comparing the results of this research and the conventional rankings provided, the strengths of this model became clear.

Conclusion 17: One of the important results of this research was the demonstration of the superiority of the detection power of the combined approach compared to the non-combined TOPSIS approach (as one of the common ranking methods). Due to the comparisons made, the use of the conceptual model of this

research for companies as well as investors will be highly constructive in making better decisions.

Conclusion 18: The companies at the first rank need to develop a proper strategy to maintain their position. Meanwhile, weaker corporations have to focus on lowering their gap with stronger firms and try to improve their position in the ranking.

Conclusion 19: The decision making model of the present research was used in the ranking of companies according to the financial information. This model can be used in all decision makings regarding financial and non-financial ranking as well as in choosing a proper option.

Finally, we suggest to use the proposed method in the later studies for evaluating other industries. In addition, other financial ratios can be used instead of the financial ratios utilized here. Future studies can use the proposed model to rank the top 100 companies (presented by the Industrial Management Organization) and compare the results with each other.

Also, the ANP and TOPSIS integration method should be used for prioritization. In addition, with the help of decision makers from all the different groups active in Tehran Stock Exchange, taking into account each decision maker based on its importance (weighting decision makers), comparisons can be made and thus more reliable results. Comparison of this model with accounting methods and other performance evaluation methods (Prometheus, Electro) is another suggestion for future research.

Also, in terms of its application, taking into account the results of this research, it is recommended that companies with inappropriate performance be offered a solution. Appropriate and use of modern scientific and applied methods improve their position among companies active in this industry and it is suggested to investors to invest in companies in order to reduce their investment risk in companies with better performance and performance.

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