Evaluating and Ranking Performance by Combination Model of Balanced Scorecard and Ariadne Uncertain Estimate

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Abstract

The increased competition has caused organizations to maintain their supremacy using the assessment, control and improve performance in global markets. Using the balanced scorecard is a method that can help organizations achieving this goal. In this study we have tried to present a simple and useful tool for evaluating and ranking performance, incorporating balanced scorecard model and Ariandne uncertain estimate. The statistical population of this study consisted of executives and experts of ceramic & tile companies located in Ardakan, Meybod and Mehriz in Iran. The information is collected through interviews, questionnaires and data from the Iranian bourse website. This study which is an experience of using the balanced scorecard model and ARIADNE uncertain estimates in evaluating performance is presented as a simple and useful tool for evaluating and ranking performance.

Keywords: balanced scorecard, Ariadne uncertain estimate, performance evaluation, performance ranking

1. Introduction

Nowadays, business environment is changing so that the speed and diversity of these changes have had a profound impact on corporate activities. Economic changes, diversity of needs and advances in technology has led to the organization's success depends on the efficient and effective management of all aspects of their activities. An atomistic view, a non-systematic attitude and focus on trivial issues is a strategic mistake in such circumstances that will lead to a waste of resources, weakened institutions, and will result in its destruction (Kittiya & James, 2009). In this respect, prioritization of problems and improvement areas in the organization as well as assigning the key success factors seem to be necessary. Accordingly, organizations need to evaluate their performance continuously in order to determine their current status and progress in the competitive world. The correct and continuous evaluation of the performance causes to assess the strengths and weaknesses of the organization properly and helps in proper managing resources, identifying areas for improvement and development, effectiveness and increasing competitive power (Marco & Bititci, 2006). In this context, this paper attempts to provide useful tools to evaluate and rank the performance of companies in an industry. Employing this tool will help to rank the performance and define the top company in addition to determining the strengths and weaknesses of the companies. Assigning the top company will provide the context of using experiences and Pattern Making them by other companies and help to solve other companies' problems and improve their performance.

The purpose of this investigation was to evaluate the performance of tiles and ceramics companies listed on Iran bourse, by using balanced score card and Ariadne uncertain estimation and also attempts to answer the following questions:

- What are the indicators of the performance evaluation of ceramic and tile companies?

- What is the relative importance of each of these indicators?

- How are the ceramic and tile industry companies listed in Tehran stock exchange ranked?

2. Literature Review

2.1 Performance Evaluation

Performance is an Indicator of activities productivity and Achievement of objectives. The evaluating performance system can be considered as the systematic process of evaluating the level and method to achieve the desired situation. The performance measurement may cause increasing awareness of the organizational performance improvement and provides motivation and opportunity for improving the organizational performance (Folan & Brown, 2005). Totally, the goals of evaluating performance are: addressed as controlling affairs in the organization, identifying strengths and weaknesses, reforming activities, better use of resources and facilities, providing better products and services, increasing organizational efficiency and ultimately, improving decision making and increasing competitiveness in the national and international context (Tangen, 2004).

In the current world, performance evaluation is inevitable for organizations. In order to determine the level of authenticity and quality of their activity each organization requires the evaluation system. Lack of evaluation in different Dimensions of organization including how to use the resources, personnel, objectives and strategies is considered as an important organizational defect. Absence of performance evaluation systems makes it impossible to perform necessary reforms for growth, development and improvement of the organization's activities and is considered as a serious threat to the success and survival of the organization (Al-Tamimi & Charif, 2011).

Since the concept appearance of performance evaluation in the management literature, different frameworks of evaluation has been introduced by management scholars. In the past, organizations performance evaluation was performed only with an emphasis on financial measures. With the advent of the information age, intensifying competition and increasing complexity of organizational processes, management scholars have concluded that the traditional performance evaluation systems are imperfect in providing an appropriate feedback and it is necessary to design an evaluation system with respect to various aspects of the organization's activities. Although performance evaluation based on a review of financial indexes provides an overview of what has happened in the past, but this type of evaluation does not provide knowledge of the performance by all aspects of the organization's activities and in demonstrating the real value-creation factors such as the intangible asset, technical knowledge and communication network is inadequate. A performance evaluation system is required to control and supervise the performance of all organizational components, compare it with the organizational plans and goals and show the progress rate toward goals. A performance evaluation model that has these features is the evaluation method based on the balanced scorecard. This method takes into account not only financial criteria but also, other operational criteria in the areas of learning and development, internal processes and customer satisfaction. The weaknesses of traditional performance measurement systems are covered by using this method (Kaplan & Norton, 1992).

2.2 Balanced Scorecard Model

Balanced scorecard model has attracted the attention of researchers in recent years and has been used in many studies. The model was introduced by Kaplan and Norton in 1999 during a research project that was conducted in 12 countries and is recognized as a major innovation in the field of management knowledge. BSC model is superior to other performance evaluation methods because of creating a balance between financial and non-financial measures, internal and external stakeholders, long-term and short-term goals (Kitiya & James, 2009). Not only the past performance of the organization is identified using this method, but also the current status of organization and how it can meet the challenges of the future is characterized (Kaplan & Norton, 2005).

BSC provides a comprehensive view and the operational performance will also be considered in addition to financial performance. It is a management technique that helps managers to review activities from different viewpoints and identify the achievement of organizational goals. It also includes financial measures that show the results of last activity and also operational measures in areas including customer satisfaction, innovation, learning and internal processes that are the driving force of future financial performance. Considering the four aspects of financial, learning and growth, internal processes and customers, simultaneously enables better and deeper understanding of the organization performance, provides awareness of the strengths and weaknesses of all aspects of the organization and gaining higher competitive advantage in comparison to other competitors (Braam & Nijssen, 2004).

One of the most important intangible assets of organizations in attaining competitive advantage is customers. Businesses that have satisfied and loyal customers are profitable. From customer's perspective, an organization must focus on the characteristics of product/service which are value-creating in customer's view. Lack of focus on choosing target customer and selecting an inappropriate value creation approach for customer reduce the

organization's ability to gain competitive advantage. The customer aspect of balanced scorecard includes major indices and a series of sub-indices. The main indices include: customer satisfaction, customer retention, attract new customers, customer profitability and market share. The sub-indices are relevant to measuring the factors that create value for the customer and set the status of main indices. The indicators are divided into the following three groups:

• Characteristics of the product or service, including customer waiting time, cost, quality, way of operation, and product/service differentiation.

• Customer's phantasm of the organization and its reputation and credits.

• Relationship with clients including trustee, reliability, responsiveness, and after-sales services (Kaplan & Norton, 1996; Kaplan & Norton, 2004).

Goals Achievement which is assigned in the client's perspective requires for efficient and effective operational processes. In the viewpoint of the internal process, organizations must identify the processes and determine appropriate criteria for monitoring their progress. The organization's effort to achieve assigned goals in this regard helps to create value for clients and stakeholders (Kaplan & Norton, 1992)

Measures of customer and internal processes perspective identify such criteria that will be significant in the competitive success of the organization. In order to achieve the goals set for these two perspectives, organizations must improve their products and processes and have the ability to introduce new products and processes. In this regard another aspect that is taken into account in the balanced scorecard is learning and growth perspective (Kaplan & Norton, 1992, 1996, 2005). Learning and growth perspective considers the development of an intangible asset of organization and will focus on method of education, acquiring knowledge and how to use it. The long-term objectives of this perspective are increased flexibility and investment for future development and utilization of new opportunities. Learning and growth perspective involves activities which is often managed by the department of human resources, finance and information technology (Kaplan & Norton, 1992, 1996, 2005)

Another aspect of the balanced scorecard is the financial perspective. Measures of this perspective show financial results and achievements from successful implementation of the defined objectives in terms of the other three perspectives. The financial perspective of the balanced scorecard states shareholder requirements and considers goals of profitability, return on investment, economic value added, sales and cash flow (Kaplan & Norton, 1992, 1996, 2004).

Also, the balanced scorecard puts vision and strategies in the center of operations control and will translate them into four key indicators of success in financial, learning and growth, customer and internal processes perspectives. In other words, the foundation and the basis of the BSC is the strategic plan and its successful implementation is based on accurate outlining of causal relationships between the organization's strategic objectives in the four described perspectives (Kaplan & Norton, 1996).

2.3 Ariadne Uncertain Estimate

Optimization models were considered by mathematicians since the industrial revolution especially after the Second World War and have found many applications in economics and management. At the beginning, the classical optimization models were mostly used. These models focus on having a criterion (objective function), so that can be linear, nonlinear or a combination. But in recent decades, Multiple Criteria models were considered by researchers for assessing complex decision-making. In these models, multiple criteria are used rather than using as a measure of optimality. Some of the multiple criteria decision making models can be noted as the methods of AHP, TOPSIS, ELECTRE, LINMAP, MRS. A definite number is used in all of these models to quantify the relative importance or value of an option compared with the alternative option. For example, the question "from a particular aspect, option A is better or option B? and how much?" the respondent must choose his considered number with certainty for example, option A is two times better than B. When answering these questions, respondents either do not have enough confidence on a number or whether it is not possible to determine the decisive importance and prefers to specify a range of numbers instead a certain number (Asgharpour, 2006). Non-deterministic estimation method of Ariadne is a method in which the respondent is able to choose a range of numbers in order to determine the importance of one option over another option. However, in fuzzy approach the number of uncertain is used to decide, but the advantage of Ariadne method is that the method of Ariadne works simpler and is easier for people to understand rather than fuzzy method. Also in fuzzy methods, preferences are given expression in the form of words and then the words are calculated as fuzzy in the form of numbers, while Ariadne method first defines a range of numbers for respondents and one must choose

among a range of domains. This provides the possibility to calculate accurately and make better decisions. Ariadne is a method developed by Sage and White (1984) and then has been applied by Burden (1987), Goicoechea (1994) and Goicoechea et al. (1992). The superiority of this decision-making method has been demonstrated by Ambrose et al. (1992). In this study that has been conducted to evaluate the utility and effectiveness of multiple-criteria decision making models, it was revealed that the method Ariadne has higher performance and utility rather than the other methods.

The main idea of the method Ariadne is forming a linear programming model for each decision-making option and then solving it to find the maximum and minimum amount of value function for these options. The linear programming model of Ariadne method is written as follows:

$$Max \ / \ MinZ = \sum_{k=1}^{k} W_k V_{ik}$$

$$S.t$$

$$\sum_{k=1}^{K} W_k = 1$$

$$LB \leq W_k \leq UB \qquad (i = 1,2,...)$$

$$W_k \geq 0$$

(1)

In this model, W represents the weight, V represents the value, LB is Lower Bound and UB is the Upper Bound. i and k are indices corresponding to decision-making options and criteria, respectively. In this model problem with the minimization objective function is solved to find a lower bound for the indicators weight and the problem with maximization objective function is solved to find the upper bound of the weights (Asgharpour, 2006).

2.4 Previous Studies

Table 1. Background of BSC and MCDM methods

Author	method	Year
H. Yi Wu, et al.	DEMATEL, ANP, VIKOR , BSC	2011
J. Jassbi, et al.	Fuzzy DEMATEL ,BSC	2011
A. Safaei Ghadikolaei, et al.	DEMATEL	2011
H. Amiran et al.	Fuzzy AHP, Fuzzy TOPSIS	2011
M. Shaverdi et al.	Fuzzy AHP, TOPSIS, VIKOR, ELECTRE	2011
M. M. Fouladgar et al.	Fuzzy AHP, Fuzzy TOPSIS	2011
M. L. Tseng	Fuzzy ANP, DEMATEL, BSC	2010
I. Yuksel & M. Dag˘deviren	Fuzzy ANP, BSC	2010
M. Fasanghari, et al.	TOPSIS , BSC	2009
C. Y. Mao , et al.	TOPSIS , BSC	2009
H. Yi Wu , et al.	Fuzzy AHP, TOPSIS, VIKOR, SAW, BSC	2009
Y. Wang, Q. Xia	Fuzzy AHP, BSC	2009
Y. Oh, et al.	ANP , BSC	2009
Y. He, et al.	TOPSIS, BSC	2009
M. R Mehregan & M. Dehghan	TOPSIS , BSC	2009
U. Cebeci	Fuzzy AHP , BSC	2009
W-H Tsai, et al.	DEMATEL , ANP, ZOGP, BSC	2009
A. H. I. Lee , et al.	Fuzzy AHP , BSC	2008
M. C. Lee	AHP, ANP, BSC	2007
A. Haghshenas, et al.	Fuzzy AHP, BSC	2007
J. Thakkar , et al.	ANP , BSC	2006
LC Leung , et al.	AHP , ANP ,BSC	2006

Many studies in the management areas have shown that balanced scorecard is a suitable technique for performance measurement. Since the introduction of the Balanced Scorecard tool, it has been used in many studies.

In recent years, researchers have tried to give more credibility to their results, applying the deciding methods of MCDM and fuzzy method with balanced scorecard approach. For example, Hung (2009), Kim and Kim (2009), Varma et al. (2008), Chan (2006), Lee Ong et al. (2006), Fletcher and Smith (2004) and Reisinger et al. (2003 have used hierarchical analysis with balanced scorecard in their research. TOPSIS and VIKOR methods have been used in researches by Tezeng et al. (2005), Opricovic and Tezeng (2007) and (2004). Wu et al. (2011) and Jassbi et al. (2011) have used DEMATEL approach in their research. The table 1 shows researches conducted on the using background of Balanced Scorecard and MCDM methods of decision-making from 2006 until 2011.
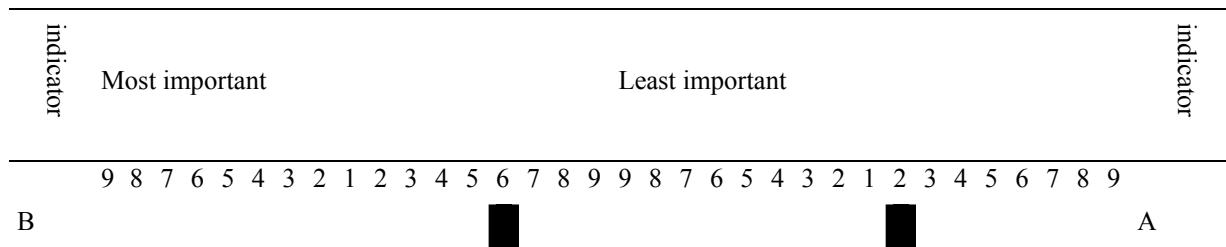
Reviewing the research literature suggests that the uncertain estimation models with balanced scorecard have not been used for performance evaluation. This study is an attempt to present a simple and efficient method for evaluating and ranking performance, combining these two techniques.

3. Method

In terms of aim, the study is placed in the area of applied research because it focuses on surveying to solve a problem in real-world and the results can be applied in the real decision-making situations. Also, from the viewpoint of the way of collecting information, it is placed in the area of survey and analysis research because it studies characteristics of a population and seeks to analyze and process the data. In this study, library method such as: books, scientific journals, online databases of Iran stock exchange website and questionnaires have been used for gathering information. The software EXL, SPSS and lingo has been used to analyze the data.

In this study, first we have tried to choose the performance evaluation criteria, reviewing the studies on the balanced scorecard and goals and vision of tiles companies. Next, the appropriate criterion for assessing the performance of companies was selected among these criteria through the poll of four tile industry experts and university professors. Next, a questionnaire appropriate for Ariadne method was designed in order to determine weights of the criteria. The respondents were asked to determine the minimum and maximum extent that each criterion is important relative to other criteria, marking related place in the questionnaire. Respondent must chose the relative importance of these criteria by selecting one of the numbers 2-9 from the right side of table if the right indicator is more important and if the left indicator is more important, choose one of the numbers 2-9 on the left. Also, if both indicators are equally important, the number 1 should be selected. For example if indicator A is more important than B and minimum importance of A is 2 and the maximum is 6, responses by the respondents should be set this way (Table2).

Table 2. Method of complete the questionnaire

indicator	Most important	Least important	indicator
	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9		
B	■	■	A

After the questionnaire was designed, its reliability and validity was tested. In order to check the validity of the questionnaire, it was given to some professors and their corrective views were taken into consideration on final design. The reliability of the questionnaire was calculated using Cronbach's alpha test. The Alpha coefficient was equal to 0.892 and 0.83 for the minimum and maximum norms, respectively that indicates the reliability of the questionnaire.

Since we have conducted a survey of managers and experts of tile industry in this study with the purpose of weighting criteria, the population involves managers and experts of ceramic and tile companies located in the cities of Ardakan, Mehriz and Meybod in Yazd Province who were of high academic qualifications and work experience of over 5 years. Sampling method were the available method and researchers asked to complete it, referring to companies and providing the questionnaire. Totally 100 questionnaires were distributed, referring to 18 companies that 65 of them were used. The way of answering was trained to the experts and managers by

creating an instruction sheet for completing the questionnaire, and to eliminate potential ambiguities the researcher was present when completing the questionnaires.

4. Results

By surveying the principles and definitions presented in the literature about the aspects of balanced scorecard and also conducted studies (Studies presented in Table 1), the criterion of performance evaluation that Used in these studies has been determined in four perspectives: financial, learning and growth, customer and internal process. Also To use the BSC model, it is necessary to express visions and strategic objectives of the company. Accordingly, referring to IRAN Stock Exchange website and studying annual objectives and strategies of companies tiles in this study, the most important long-term goals and their vision was extracted based on the four perspectives of the balanced scorecard (Table 3).

Table 3. Long-term goals of tile corporations

Aspects of BSC	Strategic Goals
Financial	Increased productivity, Increasing shareholder returns, Optimal management of costs and revenues, Improve the identification of suppliers, increased average sale price.
Learning and growth	Purchase and installation of office automation system, emphasis on satisfaction and loyalty of employees, improve employee skills.
Customer	Improve Goods quality, increase market share, Development services and products.
Internal process	Leading provider of products and services, Improve the financial structure

Considering the extracted criteria of the conducted studies and survey of vision and strategy, a survey of academic professors and four tile industry experts has been done. Performance evaluation criteria were established in four perspectives of balanced scorecard which has been shown in figure 1.
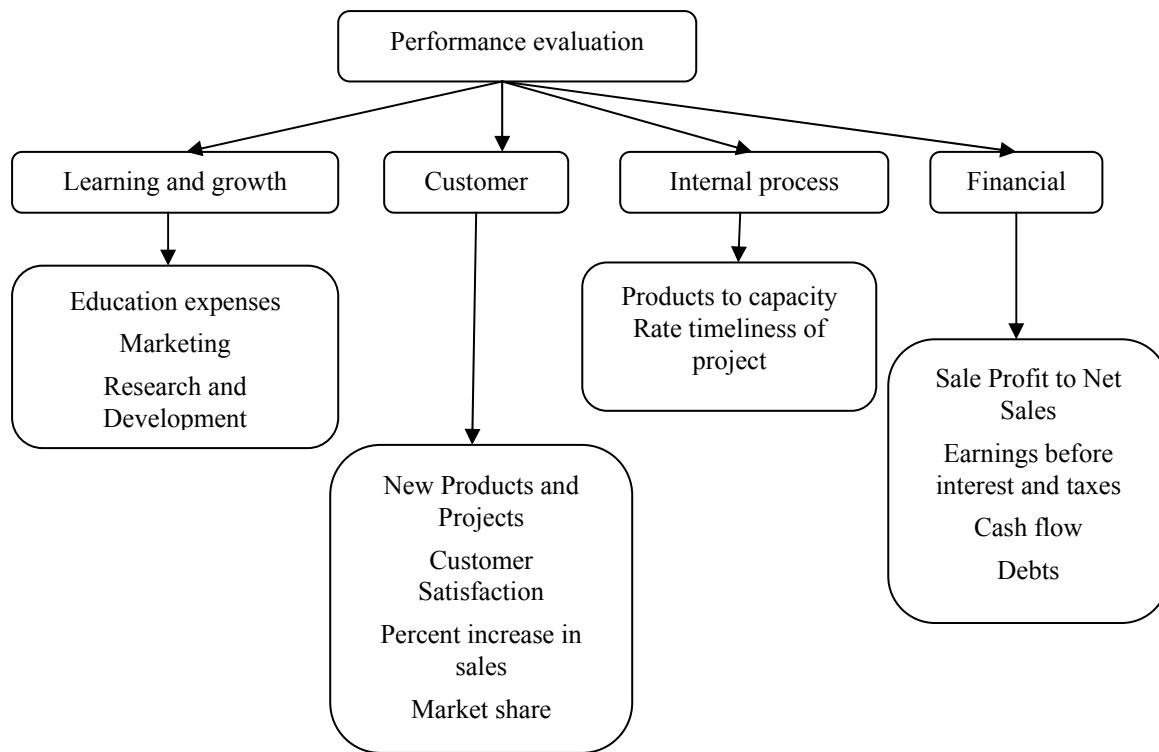

Figure 1. Performance evaluation criteria

After identifying the indicators of performance evaluation, the researchers referred to IRAN Stock Exchange received data on these indicators for the eight companies listed in the stock exchange. A quantitative amount of the evaluation criteria, such as debt, sales and revenues were derived directly from the data. But a few other criteria such as timeliness rate of project implementation, the nominal capacity of the products and market share were calculated according to data. How to do the calculations for these measures is presented below.

-The timeliness rate of project implementation:

Tile companies define and implement projects in order to develop. Timeliness rate of project implementation has been calculated for each company by averaging the percent of those projects' improvement at the end of the year.

-The ratio of each company's products to its nominal capacity:

The criterion is achieved by dividing the actual production capacity (total production per the current year) on the nominal capacity.

-Increased percent of sales:

For calculation of this criterion, the sales of three years of 2007, 2008 and 2009 are used.

-Market share:

This factor is calculated by dividing the tile sales for any company on total sales of Companies in Stock in the three years 2007, 2008 and 2009.

-Customer satisfaction:

Customer satisfaction indicator has been calculated by dividing the number of customers on the number of customers of previous year in the three years 2007, 2008 and 2009. Because increasing or decreasing the number of customers per year indicates the company performance and also expresses customers' satisfactions that use their products.

-The cost of education on income:

Each company allocates part of its income to staff education. The criterion has been calculated by dividing education expenditure on income before taxes and interest.

-Research and Development:

The company's expenditure for research and development used for their projects and products

-Marketing:

These criteria include the costs that companies have spent presenting in exhibitions, Television advertising, etc.

Table 4. Quantitative amount of criteria

Criterion Company	Isfahan	Alvand	Pars	Tak Ceram	Hafez	Saadi	Sina	Nilou
Sale	320318	554873	202865	103985	266994	129695	310875	325087
Profit to Net Sales	0.189	0.352	0.237	0.002	0.334	0.309	0.26	0.17
Earnings	21332	32217	131	9930	4774	10700	2241	15285
Cash flow	37099	43473	33285	1107	33482	14162	16602	23173
Debts	27705	218951	411139	10134	129990	231914	26754	300122
New Products and Projects	4	5	3	2	5	4	3	4
Customer Satisfaction	0.753	0.932	0.877	1.522	0.927	0.786	0.856	1.027
increase in sales	18	17	30	64	25	30	24	21
Market share	0.154	0.223	0.084	0.044	0.141	0.062	0.134	0.157
Products to capacity	1.04	0.71	0.83	0.64	0.99	0.79	1	1.01
timeliness of project	0.6	0.71	0.52	0.8	0.59	0.65	0.75	0.66
Education expenses	0.01	0.015	0.007	0.02	0.03	0.018	0.017	0.02
R&D	47000	9000	3560	2310	3245	47500	18500	13000
Marketing	5600	5520	3865	1420	1786	60	3357	776

Quantitative amount of criteria are presented in the table 4. The data must be normalized in order to equalize the scale of evaluation criteria and their use in Ariadne uncertain model. In this study because there are both the positive and negative aspects of indicators the linear Normalization method is used. According to this method values r_{ij} is divided on maximum amount of criteria (r_j) for positive indicators. In other words, we have:

$$n_{ij} = \frac{r_{ij}}{r_j^*} \quad , \quad r_j^* = \underset{i}{Max}\, r_{ij}$$

(2)

For negative indicator this is done as follows:

$$n_{ij} = \frac{r_j^*}{r_{ij}} \quad , \quad r_j^* = \underset{i}{Min}\, r_{ij}$$

(3)

The obtained values would be between zero and one by normalization the data. For criteria involving negative aspect, 1 indicates the worst performance and 0 represents the best performance of the company. Also, for criteria involving positive aspect, 1 indicates the best worst performance and 0 represents the worst performance of the company. The normalization results are presented in Table 5.

After identifying and quantifying criteria, a questionnaire was designed to calculate the importance weight of each criterion in comparison with other fourteen criteria. Geometric mean of the data obtained from the questionnaires was calculated for the least important and most important criteria using Excel software. The results are presented in Table 6.

According to information obtained from the decision-making table (table 5) and also the weight range of sub-criteria (Table 6), the uncertain estimate model was determined for each company, and was solved using the software lingo. For example, the uncertain model of financial perspective of Isfahan tile Co. is as follows where f=sales, e=the ratio of profit to net sales, d= Earnings, r=is the cash flow and b=debt amount.

$$Max/Min\,Z = 0.5772\,f + 0.5366\,e + 0.6621\,d + 0.8533\,r + 0.3657\,b$$
$$s.t.$$
$$f + e + d + r + b = 1$$
$$0.2 \le f \le 0.5$$
$$005 \le e \le 0.2$$
$$0.1 \le d \le 0.3$$
$$0.05 \le r \le 0.15$$
$$0.1 \le b \le 0.5$$
$$0.2 \le f \le 0.25$$
$$f, e, d, r, b \ge 0$$

(4)

Table 5. Quantitative amount of criteria

Criterion Company	Isfahan	Alvand	Pars	Tak Ceram	Hafez	Saadi	Sina	Nilou
Sale	0.5775	1	0.366	0.187	0.481	0.234	0.560	0.589
Profit to Net Sales	0.537	1	0.672	0.006	0.948	0.876	0.738	0.483
Earnings	0.662	1	0.004	0.308	0.148	0.332	0.07	0.474
Cash flow	0.853	1	0.765	0.025	0.77	0.326	0.382	0.533
Debts	0.366	0.046	0.025	1	0.078	0.044	0.379	0.034
New Products and	0.8	1	0.6	0.4	1	0.8	0.6	0.8

Criterion Company	Isfahan	Alvand	Pars	Tak Ceram	Hafez	Saadi	Sina	Nilou
Projects								
Customer Satisfaction	0.495	0.612	0.576	1	0.608	0.516	0.562	0.674
increase in sales	0.281	0.266	0.469	1	0.391	0.469	0.375	0.328
Market share	0.691	1	0.378	0.196	0.632	0.28	0.601	0.702
Products to capacity	1	0.683	0.798	0.615	0.952	0.76	0.962	0.971
timeliness of project	0.75	0.888	0.65	1	0.738	0.813	0.938	0.825
Education expenses	0.667	0.013	0.307	1	0.119	0.8	0.4	0.101
R&D	0.99	0.189	0.075	0.049	0.068	1	0.389	0.274
Sale	0.5775	1	0.366	0.187	0.481	0.234	0.560	0.589
Marketing	1	0.986	0.69	0.254	0.319	0.011	0.599	0.139

The lower and upper bounds of the financial perspective of Isfahan tile co. was calculated using above model. Similarly, the bounds of other indicators will be calculated for other companies. In Table 7, the upper and lower bounds of each balanced scorecard perspectives have been presented for eight companies.

Table 6. The lower and upper limit of criteria

Criterion	least important	Most important	Criterion	least important	Most important
Sale	0.2	0.5	Increase in sales	0.2	0.3
Profit to Net Sales	0.05	0.2	Market share	0.1	0.13
Earnings	0.1	0.3	Products to capacity	0.1	0.15
Cash flow	0.05	0.15	Timeliness of project	0.05	0.1
Debts	0.1	0.25	Education expenses	0.01	0 .1
Marketing	0.2	0.32	R&D	0.15	0.2
Customer Satisfaction	0.25	0.4	New Products and Projects	0.1	0.15

Comparing results of the table 7, the company's performance can be ranked in each of the four aspects. The results show that in the financial perspective firms Alvand, Isfahan, Nilou, Sina, Hafez, Saadi, Tak Ceram and Pars have the best performance, respectively. In the customer's perspective firms Hafez, Alvand, Nilou, Saadi, Isfahan, Pars, Sina and Tak Ceram have the best performance, respectively. The results of the internal process perspective also show that firms Alvand, Hafez, Isfahan, Nilou, Tak Ceram, Pars, Sina and Saadi have the best performance, respectively. In terms of growth and learning aspect firms Alvand, Hafez, Isfahan, Tak Ceram, Sina, Pars, Nilou and Saadi have the best performance, respectively. The best performance of the four balanced scorecard perspectives can also be determined for each firm. For example, Isfahan Co. has the best performance in financial perspective and the worst performance in growth and learning perspective.

Tabla 7. Bounds of balanced scorecard indicators for companies

Criterion Company	Financial		Customer		Internal process		Learning and growth	
	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound
Isfahan	0.539	0.621	0.378	0.606	0.388	0.506	0.323	0.455
Alvand	0.762	0.905	0.452	0.768	0.552	0.778	0.422	0.837
Pars	0.207	0.416	0.375	0.504	0.279	0.324	0.275	0.324
Tak Ceram	0.22	0.41	0.36	0.65	0.32	0.542	0.321	0.523
Hafez	0.318	0.544	0.470	0.725	0.401	0.815	0.421	0.562
Saadi	0.237	0.387	0.395	0.588	0.232	0.324	0.232	0.337
Sina	0.35	0.511	0.375	0.512	0.252	0.422	0.302	0.415
Nilou	0.39	0.496	0.428	0.639	0.329	0.540	0.254	0.415

After calculating the upper and lower bounds for each of the four aspects of the balanced scorecard, final results and weights related to each firm was obtained by putting the data of each company into Ariadne model and solving with software lingo11. The results presented in Table 8 shows the final weights of companies. Lower bound of Alvand co. is higher than the upper bound of all of companies so, it can be claimed that the company has the best performance compared to other companies. Then after Alvand co., Isfahan co. has the highest lower bound. The comparison of eight companies is shown in the table, as indicated in this table after Alvand and Isfahan co., Takceram, Saadi, Nilou, Sina and Pars have the best performance, respectively.

5. Conclusion and Recommendation

Nowadays with the increased competitive global market, organizations are looking for ways to improve their performance and increase their competitiveness abilities. Through products and processes improvement, organizations are trying to increase customer satisfaction and their profitability. Due to today's dynamic and changing environment, the organizations which have been assessing and improving their performance and activities continually are successful in achieving these goals.

One model that has been proven to be effective in several studies and can help organizations to evaluate the performance is the balanced scorecard model. In this study, we have tried to provide a practical experience of using a combination model of the balanced scorecard and Ariadne uncertain estimation. Being compatible with the reality, simple and easily understood in designing the questionnaire and surveying business experts are the features of Ariadne uncertain estimation method which has increased the validity of the results of applying this approach to decision-making. Therefore, simultaneously using both this method and the balanced scorecard in evaluating the performance will help enhancing the credibility of the survey results. The hybrid model can be used to evaluate the performance in different industries.

Table 8. Upper and lower bounds for each company

Corporate	lower bound	Upper bound
Alvand	0.767	0.850
Isfahan	0.630	0.705
Hafez	0.541	0.620
Tak Ceram	0.501	0.540
Saadi	0.460	0.491
Nilou	0.432	0.452
Sina	0.362	0.395
Pars	0.289	0.352

In this study, the approach has been used also with restrictions in addition to the restrictions in the field and data collection methods among which it may be referred to the lack of quantitative data for some of the indicators of performance evaluation. This limitation has prompted researchers to use available data to calculate some of these indicators that can affect the validity of the results. For future research it is recommended to use other uncertain methods such as HIPRE methods combined with the performance scorecard method. In order to compare uncertain methods with other Multi Criteria Decision Making methods of performance evaluation, it is proposed to conduct a study in order to compare the performance of these methods together so that to determine which of these methods can lead to reliable results combined with the balanced scorecard. The effectiveness of uncertain approach with fuzzy methods of performance evaluation can also be compared in a research.

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