

Application of VIKOR-BSC Model in Development of Organizational Entrepreneurship

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Abstract: Entrepreneurship is an important factor in development of countries. One of the main approaches of entrepreneurship is entrepreneurship in organization that results in competitive advantages, innovation and leadership for organizations. On the other hand nowadays the strategic management including planning and appraising play a major role in organizations. In the present article, we used VIKOR technique which is one of the methods of multiple attribute decision making for ranking the indices of organizational entrepreneurship development based on BSC factors which is one of the most critical tools for strategic appraisal in organization. The case study of the research is Qazvin Islamic Azad University in Iran.

Key words: Organizational Entrepreneurship • Balanced Scorecard (BSC) • Multiple Attribute Decision Making • VIKOR

INTRODUCTION

Current world of business is a dynamic space in which the rate of change and development is high. Those organizations that can change themselves based on current changes while having suitable flexibility can continue to live in such space. Based on existing theories in management, one of the roles of managers is entrepreneurship that nowadays is of great importance. Entrepreneurship is an important subject that many of the developed and developing countries have and will have taken into consideration seriously. Meanwhile, one of the main branches of entrepreneurship is entrepreneurship in organization that doubtlessly has a remarkable share in the success and elevation of organizations [1]. Nowadays many companies understand the need of corporate entrepreneurship [2]. Corporate entrepreneurship is a series of activities that make benefiting from innovative competitive advantages possible and is an approach to institutionalize innovation in organizations [3]. Nowadays, the application of a strategic approach in management of organizations, whether in planning or in appraising, has been taken into consideration. Balance Scorecard (BSC) is one of the strategic management tools that has been used considerably in the past few years. Although BSC has been initially introduced to organizations as a

technique for evaluation of operation, this gradually changed to a strategic management system for many companies. In this way, companies went beyond the initial goals of Kaplan and Norton (1992). Many companies, such as Rico and Takara Shoes, found out that BSC can also specify the reasons of unfavorable operation and insufficiencies of existing system by analyzing exact details among goals, operation assessment and actual results; and therefore they used BSC as a strategic management system. Harvard Business Review magazine chose BSC as one of the 75 ideas that have the most effect in the twentieth century [4]. In addition, concerning articles and documents referred to in each strategic conversion to “BSC” during three years, the well-known book of “Kaplan” has the most references [5]. On the other hand, decision-making is one of the important functions of managers. This is so important that some persons consider management as decision-making. With a view to this fact that no decision is taken in actual space based on one criterion, the application of a multi-criteria decision-making approach to the issues, especially in an organization, is of great importance. Identification of the best option for decision-making administrators without a systematic framework in connection with the issue of several working indices is quite difficult [6]. Considering the necessity of development of organizational

entrepreneurship in wavy atmosphere of today's competition and limitations of organizational resources, we need to identify priorities in dimensions and indices of organizational entrepreneurship with a strategic approach and to deal with more important dimensions of entrepreneurship based on a strategic thought. Therefore, the present article is seeking to deal with prioritization of indices of organizational entrepreneurship based on Balanced Scorecard (BSC) with a multi-criteria approach in the university. The present article used VIKOR in decision-making. The article has been organized as follows: in the second part, the history of conducted researches and studies has been indicated, the third part deals with the application of VIKOR model in evaluation of indices of organizational entrepreneurship and the final part is the conclusion and suggestions.

History of Research

Organizational Entrepreneurship: Nowadays development of entrepreneurship is one of the tools of economic development in developing countries and our country is not except in this respect. Based on the global declaration of entrepreneurship, there is a strong correlation between national economic growth and in the level of national and organizational entrepreneurial activity [7]. In today's developing world, successfulness belongs to those organizations that establish a significant relation between their rare resources, managerial capabilities and entrepreneurship of human resources. In other words any organization can move quickly ahead towards development that equips its human resources with knowledge and skill of generative entrepreneurship by providing necessary infrastructures so that they can use such valuable potency to manage and direct other resources of the organization towards making value and achievement of growth and development. Therefore, in order to further familiarization with this subject, we state the concept of entrepreneurship from different point of views. The word "Karafarini" is a new word in Persian and we cannot understand its actual meaning from the word. The word is used as an equivalent of "Entrepreneurship", since we could not find any suitable and clear equivalent for such word in Persian and the word "Karafarini" often misleads listeners. Generally, entrepreneurship and human has been twin since the beginning of life and it is considered as the basis for his entire evolutions and developments; in spite of all that, the exact concept and nature of this word is still unknown [8]. Some scientists consider entrepreneurship as the most important factor in organizational development. Entrepreneur is a man of

thought and innovation that creates golden opportunities with creativity, risk-taking, intellect, thought and wide vision. He can make evolution with innovations and change a losing organization to a profitable one. Organizational entrepreneurship is a process in which innovated processes or products appear by creating entrepreneurial culture in an organization [9]. Organizational entrepreneurship benefits from resources and supports of organizations. Innovation can be new products, organizational processes and managerial methods. In an entrepreneurial organization all are entrepreneur and the entrepreneurial manager is on the top [10]. There are different viewpoints about the definition of entrepreneurship. According to Robert Ronstadt (1984), entrepreneurship is a dynamic process towards increasing and making capital. This can be done by a person who takes the risk of losing time or other occupational opportunities towards value for a product or service [10]. This power appears only when economy is dynamic and its function is to create a new change (innovation) in the production compounds (Khareghani, 2006). In 1986, Pitter Draker expressed its opinion about entrepreneurship: "there is a great confusion in the definition of entrepreneurship; we know many persons who are not entrepreneur but have an entrepreneurial characteristic like many sellers, surgeons, reporters, journalists, etc." He also believes that entrepreneur is a person who starts a new and small profitable activity with his capital, changes values, evolves its nature and establishes a suitable business in a near future [11]. Many researchers have conducted studies on the dimensions of organizational entrepreneurship and some of those studies have been briefly indicated in table 1. The indices of organizational entrepreneurship applied in the studies [12,13] have been used in the present research.

Balanced Scorecard (BSC): Balance Scorecard (BSC) was introduced for the first time in 1992 by Kaplan and Norton in Harvard Business Review magazine. They introduced the results of their observations in a research entitled "Measurement of performance in future organization" (which was conducted in 1990) as Balanced Scorecard (BSC). Four elements measured in that model include: financial, customers, internal processes and growth and learning. In 1996, Balance Scorecard (BSC) changed to a managerial tool and indices connected to each other by a version of cause and effect. Nowadays Balance Scorecard (BSC) is known as a strategic management and learning system that considers creation of value in the long run based on comprehensive goals of a company.

Table 1: Dimensions of Entrepreneurship from Different Point of View

#	Researcher	Dimensions of Entrepreneurship
1	Antoncic, B. and Hisrich, R.D. (2001) [14]	<ul style="list-style-type: none"> •New businesses and units •Innovation in the process and product / services •Self-repetition •Risk-taking •Leading •Aggressive competition
2	Farhangi and Safarzadeh (2005) [15]	<ul style="list-style-type: none"> •Producing idea •Executing idea •Benefiting from idea
3	Khorasani <i>et al</i> (2005) [7]	<ul style="list-style-type: none"> •Style of organizational leadership •Quality of entrepreneurship
4	Zahra <i>et al</i> (2000) and Zahra (1996) [12,13]	<ul style="list-style-type: none"> •Innovation in product or service •Innovation in process •Organizational innovation •National investment •International investment •Strategic renovation

The main core of Balance Scorecard (BSC) is formed by perspective and strategy. In fact these two are the basis for formation of four aspects of Balance Scorecard (BSC) and financial results are achieved when the efforts of an organization in other three areas are guided well. The approach of Balance Scorecard (BSC), with a view to four aspects of financial, customer, internal processes and growth and learning, is seeking to create a balance between financial goals as the result of past performance of an organization in two aspects of customer and internal processes and the goals of other aspects. In this way, a balance is created between the back-casting indices (financial indices) and futurist indices (the indices of three other aspects). Learning and growth performance, which indicates the capabilities of an organization in three areas of manpower, information system and instructions and organizational procedures, have been considered as a determinant of organization performance in two aspects of customer and internal processes. Such approach puts specific emphasis on cause and effect relation between indices that begins from the aspect of learning and growth and respectively passes through the aspects of internal processes, customer and financial and describe the set of chain of connected indices as the most important element of evaluation system of organization performance. The next parts dealt with more investigations about such approach [17, 18].

VIKOR Method: VIKOR is a compromise MADM method developed by Opricovic and Tzeng [19] based on LP Metric.

$$L_{pi} = \left\{ \sum_{j=1}^n \left[w_j (f_j^* - f_{ij}) / (f_j^* - f_j^-) \right]^p \right\}^{1/p} \quad (1)$$

$$1 \leq p \leq +\infty; i = 1, 2, \dots, I.$$

This method can provide a maximum group satisfaction for the majority and a minimum individual effect for opposition.

Stages of VIKOR Method: The stages of this method include the following steps [19]:

Calculation of Normalized Quantities: We suppose that we have m option and n criterion. The different options of i are specified as x_i . For the option x_j the rank of j aspect is specified as x_{ij} and so for other options. x_{ij} is the value and quantity of j criterion. For normalization process of quantities, where x_{ij} is the main value of i option and j dimension:

$$f_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^n x_{ij}^2}}, i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n \quad (2)$$

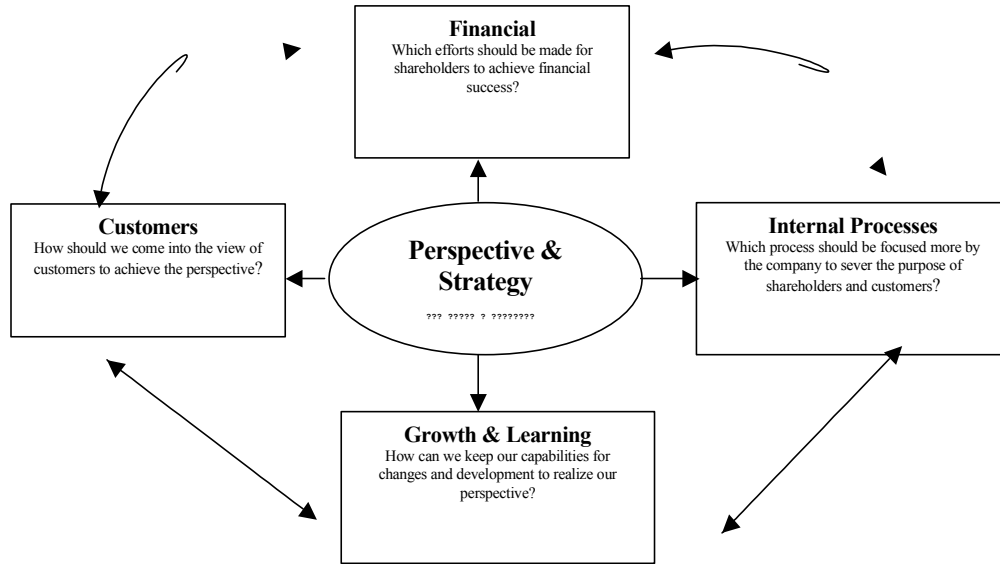


Fig. 1: Framework of Balanced Scorecard (BSC) [17]

Determination of Best and Worst Quantity: We identify the best and worst of each one of the quantities in any criterion and respectively call them f_j^* and f_j^- .

$$f_j^* = \text{Max } f_{ij}, i = 1, 2, \dots, m \quad (3)$$

$$f_j^- = \text{Min } f_{ij}, j = 1, 2, \dots, n \quad (4)$$

Where f_j^* is the best positive ideal solution for j criterion and f_j^- is the worst negative ideal solution for j created. If we join all f_j^* together we will have an optimum combination that gives the maximum point and this is also true for f_j^- .

Determining the Weight of Criteria: The weights of criteria should have been calculated in order to express the importance of their relations. In this article, AHP method will be used.

Calculating the Distance of Options from Ideal Solution: This is the stage of calculating the distance of each option from the ideal solution and then their sum for final value based on the following relations:

$$S_i = \sum_{j=1}^n w_j (f_j^* - f_{ij}) / (f_j^* - f_j^-) \quad (5)$$

$$R_i = \text{Max}_j [w_j (f_j^* - f_{ij}) / (f_j^* - f_j^-)] \quad (6)$$

Where S_i represents the ratio of distance of i option from positive ideal solution (best combination) and R_i represents the ratio of distance of i option from negative ideal solution (worst combination). The highest rank is obtained based the value of S_i and the worst rank is obtained based on the value R_i . In other words, S_i and R_i are respectively L_{1i} and L_{2i} in LP Metric method.

Calculating the quantity of VIKOR Q_i : The quantity for each i is defined as follows:

$$Q_i = v \left[\frac{S_i - S^*}{S^- - S^*} \right] + (1 - v) \left[\frac{R_i - R^*}{R^- - R^*} \right] \quad (7)$$

Where $S^- = \text{Max}_i S_i$, $S^* = \text{Min}_i S_i$, $R^- = \text{Max}_i R_i$ and $R^* = \text{Min}_i R_i$ and v is strategic weight of the majority

agreed criterion or maximum group satisfaction.

$\left[\frac{S_i - S^*}{S^- - S^*} \right]$ represent the ratio of distance from negative

ideal solution of i option, i.e. majority agreement for i ratio.

$\left[\frac{R_i - R^*}{R^- - R^*} \right]$ represent the ratio of distance from ideal

solution of i option, i.e. disagreement with i option.

Therefore, when the quantity of v is higher than 0.5, the index Q_i leads to majority agreement; and when the lower than 0.5, the the index Q_i represents negative attitude of the majority. Generally, when the quantity of v is equal to 0.5, this represents compromise attitude of the evaluating experts.

Ranking Options Based on the Quantity of Q_i : In this stage, we rank options based on the quantity of Q_i calculated in the former step and then decide.

A Review on Conducted Studies: Valmahdi and Firouzeh [20] undertook a case study to evaluate organizational performance based on BSC. The study was conducted in an educational organization based on Shanon's entropy. Another study was conducted to evaluate the taxation performance in the city of Tehran based on Balanced Scorecard (BSC) model [21]. In a research, the researchers evaluated the efficiency of supervision in an Iranian bank by composing BSC and DEA [22]. In another study, the researches presented an evaluation model for the superior faculties of management of the universities in Tehran province. They used a coherent approach of BSC-TOPSIS in that research [23]. In a study [24], the researchers evaluated the performance with approach to Balanced Scorecard (BSC) in Tabarestan Steel Company. In 2006, Barati *et al* evaluated the performance management system of the personnel in Amiralmomenin Hospital [25]. The researchers presented a quantitative model of evaluation based on Balanced Scorecard (BSC). This model was developed to evaluate the special value of the brand name and trademark of the products by using the techniques of fuzzy network analysis and data envelopment analysis [26]. A study [27] dealt with the case study of the effect of Balanced Scorecard (BSC) on business processes management in two Iranian organizations. Alvani and Abdollahpour studied the role of social capital in organizational entrepreneurship [28]. The study conducted by Khanifer and Vakili [29] dealt with the relation between the type of organizational-economic structure and organizational entrepreneurship in small and average companies. Another study was conducted by Imanipour and Zivdar [30] entitled "study of the relation between corporate entrepreneurship and performance. The results indicate a significant positive correlation between corporate entrepreneurship and performance. Yadollah Farsi *et al* [31] studied inter-organizational entrepreneurship in governmental

organizations in Khuzestan Agricultural Jihad Organization. The results indicate that there is a significant positive correlation between all organizational variables including control, decision-making, communications, risk-taking, change, innovation, education and research, formation of group, goals and bonus of organization both in current condition and in connection with the approach of directors. Liung and Chuang [32] presented a multi-criteria combinational model for selecting suppliers in outsourcing. In that model, VIKOR, ANP and DEMATEL were used. Wu, Tzeng and Chen [33] used VIKOR, AHP and TOPSIS to develop an evaluating model based on Balanced Scorecard (BSC) to evaluate banking performance. Chang and Hsu [34] presented an analytical model to prioritize strategies of limitation of resources used by applying VIKOR method. Chen and Wang [35] used fuzzy VIKOR to optimize choosing partner in outsourcing projects of IT/information systems. Sanayei, Mousavi and Yazdankhah [36], in order to choose supplier based on group decision-making benefits from VIKOR technique under fuzzy condition. Opricovic [37] presented a compromise solution for planning water resources using MCDM. He used VIKOR method in the study. Wu, Xu \and Yan [38] used VIKOR to evaluate electronic equipment. Huang and Yan [39] conducted a study to evaluate credit risk in energy institutes based on VIKOR. Kong, Zhang and Liu [40] by application of fuzzy VIKOR and ANP, conducted a study on technical innovation. Dai, Liu and Zhang [41] used VIKOR and AHP in a fuzzy environment to choose a supplier in the supplying chain. Liu and Du [42] conducted a study on choosing a supplier with approach to combination indices using VIKOR. Jiangchang, Zhiwei and Lin [43] used VIKOR to deal with the issue of evaluating and choosing a supplier in the supply chain. Lixin, Ying and Zhiguang [44] used VIKOR and ANP to choose a supplier. Buyukozkan and Ruan [45] evaluated software development projects by using a fuzzy decision-making approach. In that model, VIKOR method was used. Tong, Chen and Hung [46] optimized multiple response processes by using VIKOR method.

Research Methodology: In this section, considering the research subject, first we should draw decision tree. We should initially obtain the weight of criteria, i.e. four dimensions of Balanced Scorecard (BSC), through paired comparison and calculate the comparison score of studying options, i.e. entrepreneurship indices, based on

Table 2: Calculated Weights of Evaluation Criteria

#	Criterion (Four Dimensions of BSC)	Weight Calculated based on AHP method
1	Internal Processes	0.152
2	Growth & Learning	0.366
3	Internal Processes	0.322
4	Financial	0.16

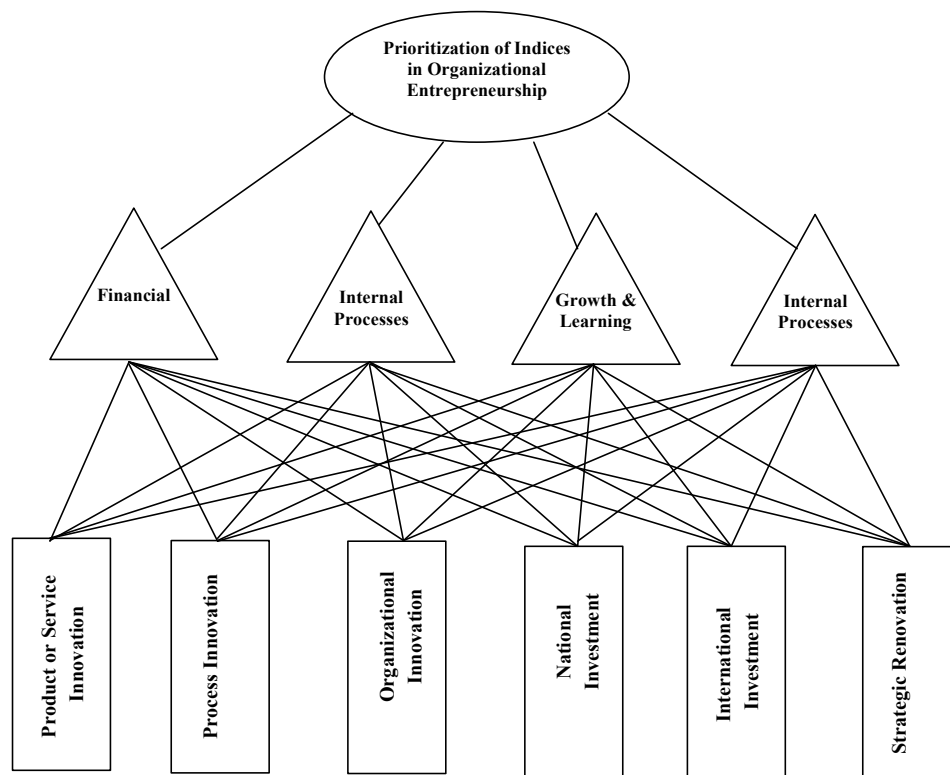


Fig. 2: Decision Tree

each dimension. For paired comparison, the nine-part scale stated by Saati [30] was used. As usual, comparisons were made by standard questionnaire AHP and its result was converted to matrices of paired comparisons. According to Saati, the geometric mean approach was used to combine the opinions of persons who compare. For accuracy in the results of research, a questionnaire was designed and sent to 12 directors of Islamic Azad University, Ghazvin, of which 6 questionnaires were returned and used as the basis of calculations based on the expert opinions and AHP method, which were shown in Table 2.

Application of Vikor in Evaluation of Entrepreneurship Indices:

Considering the literature review concerning evaluation indices as well as the dimensions of organizational entrepreneurship, the decision tree is based on Figure 2.

With a view to expert opinions, the matrices of scores of each one of the entrepreneurial indices based on Balance Scorecard (BSC) are shown in table 3.

Considering the above matrix and based on relation, 2 normalized matrices are shown in table 4:

By using the weights obtained from AHP method and above normalized matrix and VIKOR method and application of relations 3 to 7, we have (Table 5).

In the above table the coefficient v for all options is assumed to be equal to 0.5. Considering the results of the present research, the university should initially deals with international investment, based on the calculated priorities, so that it can take step in the direction of entrepreneurial development by investment in international arena.

Table 3: Matrix of Final Scores of Options

	Financial	Customer	Growth and Learning	Internal Processes
Process Innovation	0.107661	0.112868	0.154079	0.238155
Produce Innovation	0.165227	0.409281	0.052831	0.085619
Organizational Innovation	0.225159	0.118743	0.291182	0.243821
Strategic Renovation	0.224949	0.070425	0.341849	0.290165
National Investment	0.147054	0.158339	0.089283	0.069769
International Investment	0.129951	0.130344	0.070776	0.07247

Table 4: Normalized matrices of final scores of options

	Financial	Customer	Growth and Learning	Internal Processes
Process Innovation	0.254679	0.229736	0.313756	0.510292
Produce Innovation	0.390857	0.833067	0.107581	0.183455
Organizational Innovation	0.532629	0.241693	0.592942	0.522431
Strategic Renovation	0.532133	0.143346	0.696116	0.621733
National Investment	0.347866	0.322288	0.18181	0.149493
International Investment	0.307408	0.265307	0.144122	0.155281

Table 5: Results of VIKOR Model in Case Study

Criteria		C1	C2	C3	C4
Weight of Criteria		0.152	0.366	0.322	0.16
Options	Process Innovation	0.254678782	0.229736464	0.313755665	0.510292123
	Product Innovation	0.390857139	0.833066728	0.107581459	0.18345516
	Organizational Innovation	0.532629249	0.241693013	0.592942268	0.522431418
	Strategic Renovation	0.532132618	0.143345843	0.696115571	0.621732514
	National Investment	0.347865636	0.322288476	0.181810106	0.149492562
	International Investment	0.307408318	0.265306576	0.144122432	0.155281106
f^+		0.532629	0.143346	0.107581	0.149493
f^-		0.254679	0.143346	0.107581	0.149493
Options	Distance from Positive Ideal Solution (Si)	Distance from Negative Ideal Solution (Ri)	Quantity (Vi)	Quantity (Qi)	Ranking
Process Innovation	2.760409899	1	0.5	0.843839308	3
Product Innovation	2.438144404	1	0.5	0.780831183	4
Organizational Innovation	1.24299253	0.857410189	0.5	0.047159635	6
Strategic Renovation	1.001786762	1	0.5	0.5	5
National Investment	3.279169025	1	0.5	0.945265119	2
International Investment	3.559119648	0.987742367	0.5	0.957017852	1

Conclusion and Suggestions: With the application of multi-criteria decision-making method of VIKOR, the present article dealt with the evaluation of prioritizing the indices of organizational entrepreneurship from strategic point of view based on Balanced Scorecard (BSC). The results indicate that international investment is the most important dimension of organizational entrepreneurship in the Islamic Azad University, Ghazvin. In the present research, the weights of criteria were extracted based on AHP method and VIKOR was used for ranking. For further researchers we can identify each one of the aspects of Scorecard in detail and then perform ranking on that basis. In addition, we can use other performance evaluation methods as the evaluation criteria. We can use

entrepreneurial indices instead of organizational entrepreneurship and use other methods, such as SAW, TOPSIS, ELCTRE or PROMTHE, for calculation of weights as well as prioritization method. We can use fuzzy numbers to make the results of research closer to reality.

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