

Assessment of Organization Performance using Combined Approach of Balanced Scorecard and Fuzzy Analytic Network Process (Case Study: A Branch of Iran University of Medical Sciences)

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Abstract

This article intends to answer the question as how through combination of BSC and Fuzzy Analytic Network Process (ANP) organization's relative performance can be assessed based on its outlook and strategies, so as both the interaction between criteria and indicators and the balance between them are taken account of.

This is an applied and descriptive research conducted through a case study and the under study in one of the medical universities in north of Iran. Through consensus and profiting from a questionnaire the data were gathered. Questionnaire validity and stability was confirmed following approval of the organization's experts. In this article, through presentation of new Fuzzy model, it has been tried to assess current strategies of the organization and the key factors associated to these strategies. Statistical population in this research includes knowledgeable and experienced managers and experts in the understudy organization.

In this article, through combination of two performance measurement models, (BSC and ANP), while profiting from a Fuzzy Approach the indicators for measurement of organization performance are identified and by combination of the two models, a comprehensive model is proposed for measurement of the organization's overall performance. In the research findings, the key constituents and the indicators associated to each constituent were pointed out based on which priority and weight of each in regard to organization's current state of performance can be determined. These weights and indicators can give a useful insight to the university managers regarding the organization performance and importance of its different aspects at organizational level. The score of 61% (out of 100) was found for the organization current performance which can serve as a good base for improvement of the organization future performance.

Keywords: strategy, performance assessment, Balanced Scorecard (BSC), Fuzzy Analytic Network Process (ANP)

Introduction

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Organization as a coordinated and goal-directed set of components which are linked to each other to achieve the aimed objective(s) is one of the most essential requirements whose existence today is strongly emphasized (Bazyar, 2003). In addition, due to the effective role of organizations and the importance of paying attention to their performance and its impact, assessment of an organization performance in its operating area is very crucial. Since an organization is composed of different elements and parts, for making sure of organization success, actions should be taken to assess fitness, correspondence and performance efficiency of these parts based on correct performance indicators in line with organizational objectives. Hence, in assessment of an organization, capitalizing on measurement outcomes and evaluation of approaches (strategies) are crucial for achieving the organization's goals and identifying the criteria for realization of organization's strategies.

In this direction, BSC as one of the performance measurement methods serves as a model or a conceptual framework for composition of a set of performance indicators in line with the strategic objectives. This model was proposed by Kaplan and Norton and follows a framework in the first step of which, organization future outlook ought to be specified. In the next step, according to the outlook prevailing in the organization, critical success factors (CSFs) and strategic goals are determined.

Research theoretical background

Present research attempts to measure organization performance using a combined BSC and Fuzzy ANP approach. In this study, the analytic network method proposed by Chang is used to develop the aimed model for performance measurement which is founded on the Theory of Fuzzy Sets and Triangular Fuzzy Numbers (Azar, 2007). In the following, a brief description of ANP and its essential elements is presented.

ANP method in 1996 was proposed by Saati for multi-criterion decision making the purpose of which is construction of a model in order to break down complex decision making problems into smaller components and by rational value assignment again into simpler components and then by combination of these values final decision making can be effected.

This method is consisted of two main parts; the first part includes groups consisted of control criteria, sub-criteria as well as the substitute (alternative) group, and the second part includes a network of vectors and bows (arches) which represent the existing dependencies, correlations and feedbacks in the decision making system. This method, finally, acts based on paired comparisons which are similar to the method applied in Analytic Hierarchy Process (AHP). The result of these calculations is a super matrix which after calculation of super matrix relations and conceptual evaluation each criterion can be ranked based on its weight. In this research, for doing the paired comparisons of the model's factors, Fuzzy method is employed in order to take

subjective issues and uncertainty in decision making into account. This method is of a higher validity compared to similar methods.

This method was proposed by Mead and Sarkis (1999) for the purpose of political analyses in evaluation of projects to help organizations act better and quicker for improvement of methods and reaching certain objectives. In 2000, Kim and Lee applied this method for selection of IT systems in response to interdependency of the evaluation laws and practical (actual) projects. Shankar and Jharkharia (2007) used this method for selection of distribution services. They showed that ANP method not only creates a better understanding of the complex relationship between assessment criteria in decision making, but also improves decision making reliability. Chang et al (2005) received the Matrix method suggested by Saati and proposed a simplified structure of ANP for inputs and outputs analysis of a large variety of production processing. According to prior studies, ANP method is mostly applied to multiple substitutes (alternatives) such as resource allocation and for improvement of decision reliability in the assessment process (Shankar and Jharkharia, 2007). In this research too, ANP method is used to construct an assessment model for effective performance measurement.

Decision making flow chart of this method can be divided into 5 stages:

1. Determining effective criteria in decision making
2. Building network
3. Doing paired comparisons and obtaining preferences vector
4. Calculation of specific matrices
5. Ranking

In regard to the subject of this study, numerous studies have been conducted so far inside and outside the country the most important of which are referred to below.

Ajami et al (2010) conducted an applied research of descriptive type and limited time scope in the Document Section of Fatemat-ol-Zarhra Hospital and the required data were gathered through interview, observation and study of the documents. According to mission of the hospital document section the objectives were measured by the perspectives composed for this section and based on the defined measurement tools for the objectives of the section, the objectives were measured. Next, the obtained quantity score was matched with the expected quantitative score and the instances of mismatches were identified following which some solutions were offered for correction of the programs, activities, and actions.

In their article, Hemmati and Abdollahzadeh (2009) by presenting a new Fuzzy model which in comparison to the traditional models showed a very small error in assessing the organization's

current strategies and estimation of their performance given the changes. Results of this research which had been obtained using linear regression were very close to reality.

Iranzadeh and Barghi (summer 2009) in their research work using BSC methodology as a performance measurement tool in line with organizations' objectives and strategies from the BSC four perspectives, i.e. finance, customer, internal processes and learning and growth investigated the organization's performance.

Asiyan et al (2009) believed that strategy-oriented organizations of all types and sizes ought to assess their strategies based on specific objectives using suitable indicators. In this article, they sought to assess strategy of an industrial unit by means of a structured model through application of Fuzzy AHP to develop the knowledge strategy assessment in Iranian organizations.

In their research, Haghshenas et al (2007) suggested a BSC and Fuzzy AHP combined approach for performance measurement of IT units in their understudy industry. The AHP was applied in combination with four major BSC perspectives (finance, customer, internal business process, and learning and growth) based on which performance indicators were structured. Since human decision making process is usually integrated and fuzzy in nature, Fuzzy AHP is used to solve the problem and an information system of Fuzzy AHP is organized to facilitate problem solving process.

Hung Yee Wu et al (2011) has published an article titled **"BSC Performance Evaluation of Education Centers Extension in Universities ..."**. The purpose of this study was development of a set of suitable indices for performance assessment based on BSC for development of educational centers in universities using multi-criterion decision making model. Given the results of the performed analyses, the perspective growth and learning was found a crucial factor which influenced the three other BSC perspectives. In addition, the perspectives internal and external processes play a significant role in assessing performance of educational centers.

Secme et al (2009) carried out a research on **"Fuzzy Performance Evaluation in Turkish Banking Sector using Analytic Hierarchy Process and TOPSIS"**. In their view, banks' performance has significant consequences for investors, shareholders and creditors, since it indicates banks' remarkable potency in the field of competition. The obtained results indicated that for performance assessment in competitive environment not only financial performance should be taken into account but also non-financial performance ought to be reckoned with.

In their study, Hung Yee Wu et al (2009) suggested a Fuzzy multi-criterion decision making approach to assess performance of banking system. The results of their analysis indicated that the proposed banking performance assessment model using BSC framework proved to be a useful and effective tool.

Chang et al (2008) stated the purpose of their research work was development of a performance assessment system using Fuzzy ANP method to provide a structure for performance measurement in hospitals and to reduce the role of human judgment.

Research methodology

Problem statement

Among the most important concerns of managers and of course the key success factors of an organization is the accurate implementation of strategies and assessment of its performance to ensure it is moving in the right direction. In addition, the prior research has indicated that managers in leadership, assessment and management of their organization performance are faced with major problems such as employees' lack of awareness and correct understanding of organization's outlook, undesirable implementation of organization's strategies and strategic objectives on the part of employees, and their reluctance and apathy to objectives of organization's outlook (Ebn-e-Rasoul et al, 2007). Hence, using a suitable method for assessment of organization's situation on its way towards the objectives is part of the priorities of large and successful organizations, and to know about desirability and quality of their activities, especially in complex and dynamic environments, all organizations urgently need to be equipped with an assessment system. On the other hand, absence of an assessment and control system in an organization is viewed as the lack of connection and communication with intra- and extra-organizational environment which eventually will lead to removal of the organization from the competition scene (Salehi et al, 2011).

The major problem of the traditional methods in performance measurement is the exclusive use of financial measurement tools which are focused on one single aspect and rely on historical information. In fact, top management of organizations looks for an integrated system which is both strategy-oriented and operation-oriented and is able to align organization's outlook and mission with customer's needs, to manage and assess business strategies, to supervise operation effectiveness, to create organizational capacities (bearing in mind that the strategies are transparent and all employees have the same understanding of it), and is able to facilitate communication of organization's outlook and strategies to different management levels, align strategic and operational plans with each other and to provide proper feedbacks.

With these advantages, BSC quickly turned into one of the most favorite performance assessment systems which investigated organization from four perspectives. In this research, we intend to investigate determinants of organization performance from the four proposed perspectives in BSC as well as relationship of these factors with each other and their effect on

one another. Kaplan and Norton believe managers and employees pay attention to what they measure and people cannot manage the thing which is not measured (Shahabi and Rostami, 2006). Since Fuzzy logic involves a multi-value concept, qualitative concepts can be expressed and transformed into mathematical concepts by it. Use of this theory allows contribution of a wider spectrum of expert opinions. Therefore, a combination of performance assessment methods of BSC, ANP and Fuzzy theory can be the right strategy to make up for the shortcomings of the traditional performance assessment system, which relies on financial measurement tools, and to improve measurement accuracy of qualitative criteria.

Research importance

Shortcoming of the traditional performance indicators and change of the competitive and manufacturing environment gave rise to a need for redesign of performance measurement systems in organizations. In the present competitive environment, firms, institutions and organizations are focused on product and service quality, reliability, after sale services and customer satisfaction. None of these dimensions can be measured by the traditional financial indicators, while these features are among the main objectives of the companies operating globally. If these features are found to be favorable, financial indicators will improve as well. The new measurement systems are mainly for the purpose of strategy implementation. Strategy implementation is the appropriate decision making based on the link between strategy and organizational structure, budget development, performance strategy, motivation systems and supervision on strategy efficiency and effectiveness.

In design of these systems, top management selects a set of criteria which results in best strategy performance. These criteria can be viewed as the firm's critical success factors at present and in the future. If these factors are improved, the firm has its strategy implemented. The important thing for organization executives is not only tracking of financial indicators which show results of the past performance but also non-financial indicators which show future performance. Unfortunately, most organizations when assessing performance compare performance results and strategies by the traditional indicators. Financial indicators, as was said, represent one aspect of the organizational performance. Performance assessment using non-financial indicators is among the issues which in the years 90s has gained popularity, because this kind of indicators has many advantages. For example, these indicators compared to financial indicators are more up-to-date and more intelligible for employees and more compatible with organization's strategies and are changeable and flexible over time according to environmental exigencies (Medori, 2000).

Research purposes

The main purpose of the research is providing an approach to assess organization performance, and the research secondary purposes are:

1. Identification of the primary and secondary performance assessment criteria
2. Determining how the identified criteria in the previous step are related to each other
3. Determining weight and significance of the performance assessment criteria in the four perspectives of BSC

Research questions:

Research questions are:

- How is the desirable performance evaluation method in which both interaction and balance between the criteria are reckoned with?
- What are the fitting strategies for realization of organization outlook (prioritization of main criteria)?
- What are the suitable performance assessment criteria from the four BSC perspectives for the organization in question (sub-criteria prioritization)?
- What are the right indicators for assessment of an organization performance (indicators prioritization)?

Research conceptual model

Research final model which includes criteria, sub-criteria, indicators and influential internal and external relationships affecting different levels is presented in the following diagram.(Figure.1)

Statistical population, sample size and sampling method

The statistical population in this research includes about 50 managers and experts from one of the branches of Iran University of Medical Sciences situated in north of the country from whom, given the expertise criteria such as having bachelor degree and higher, at least 5 year work experience, familiarity with the concept of performance assessment and having an organizational position, 30 highly experienced and skilled experts and managers were selected and the required data were received from them.

Research methodology

Present research in terms of purpose is of applied type and in terms of research methodology it is a descriptive research conducted as a case study, and in terms of data gathering it is considered a field study.

Data gathering tool and data analysis method

To collect the information on the theoretical backgrounds, library inquiry was made by study of different books, articles and scientific websites. Next, to identify the criteria and indicators of the aimed model, previous domestic and foreign researches have been reviewed. A questionnaire served as the main information gathering tool which was to be completed by the skilled managers and experts. For data analysis, Fuzzy ANP method utilizing Super Decision software has been applied to determine weight of the constituents and criteria.

Findings

The final obtained weights and priorities from the above software for the selected indicators have been provided in the table 1.

In addition, based on the obtained results from this research, the final weights, sub-criteria ranking, and BSC perspectives are presented in table 2.

The results of the main criteria ranking indicate the first rank for the “strategy of education quality improvement”, and second and third rank for the strategies “increase of research quantitative and qualitative activities” and “excellence in business and profiting from the latest IT and ICT technologies”, respectively (table 3).

It should be noted that after opinion poll with the experts at this university and based on table 4 using verbal scales of Cheng Yung and Huwang (1999), each performance indicator is given a quantitative value. A performance value of 61.6% (out of 100) was found for this university (table 5).

Conclusion

In present research, first, by study and review of the models, conceptual frameworks and prior researches, the key factors in performance assessment of the university were extracted and composed. Next, by surveying the opinions of the experts and scholars and group discussion with them, 19 components were identified for performance assessment of the understudy university and based on the identified constituents, a questionnaire was drawn up the data of which using Fuzzy ANP were analyzed.

Present research attempted to answer a number of questions in regard to performance measurement. These questions are:

- 1) How is the desirable performance assessment method in which both interaction between criteria and balance between them are provided for?

In response to this question, it can be referred to the point that since this research intends to provide a model of performance assessment based on Fuzzy ANP, and given the research literature, prior research and the information obtained from the present study, as was earlier explained, one of the features of a satisfactory performance measurement model is its balance and comprehensiveness, in the sense that such a system should include different types of performance indicators in order to cover all critical aspects (both quantitative and qualitative) for organization success. Therefore, a balance should exist between different indicators and in this research, by profiting from views of experts and scholars this requirement is met to some extent. On the other hand, for having a desirable performance, performance indicators have to be limited so as the indicators prioritization is made possible. Hence, 3 criteria, 4 sub-criteria and 12 indicators have been identified. The suggested framework includes criteria, sub-criteria, indicators and the critical internal, and external relationships at each level have been shown in the conceptual model.

2) What are the fitting strategies for realization of organization outlook?

Fitting strategies to accomplish organization's outlook, given its mission, differ from organization to organization. In fact, decision makers at top organizational level have to choose the strategies which given the existing weaknesses, strengths, opportunities and threats serve to reach the set goals.

As for the suitable strategies for the understudy university which is regarded as an educational and research institution, three strategies of higher priority relative to other strategies have been selected.

Considering the obtained weights for each criterion, from among the three selected strategies, the "strategy of education quality improvement" was ranked first following which the "strategy of quantitative and qualitative increase of research activities" and the "strategy of excellence in business and profiting from latest ICT technologies" were ranked second and third, respectively.

3) What are the suitable sub-criteria for performance assessment in the four BSC perspectives for the understudy organization (priorities and sub-criteria)?

Based on the followed procedure in this research and the obtained weights according to the experts opinion, from among the research model's sub-criteria which are the very BSC perspectives, "internal processes" has been found the most crucial perspective in performance assessment. Next, the perspectives "finance", "customer" and finally "growth and learning", respectively, played the most important role in performance assessment process.

4) What are the right indicators for assessment of an organization performance (indicators prioritization)?

Considering the BSC perspectives, each of which may have several indicators, vary from organization to organization, according to the understudy place, several relevant and corresponding indicators for each perspective have been selected.

Based on the research findings presented in table 1, by putting the indicators in descending order from the greatest weight to lightest weight, all the influential indicators in performance assessment of the understudy university were prioritized from the most important to the least important ones (based on experts' views). As is presented in table 1, the indicator "increase of employees and professors satisfaction" from among all the other indicators is found to be the most influential indicator in the system performance assessment according to the experts view. Next, the indicator "quantitative and qualitative development of service provision to students" is ranked second, and the indicator "ICT development and knowledge sharing between employees, professors and students" is ranked third, indicating the increasing significance of this indicator in today's competitive environment. After these indicators, the indicators "development of capabilities and competencies in employees, professors and students", "increase of students satisfaction" and "use of new technologies" are the fourth, fifth and sixth priorities, respectively.

- the indicators "liquidity management", "cost management" and "increase of process productivity" were ranked as the seventh, eighth and ninth priorities following which the indicators "maximum use of the existing assets and capitals", "attracting new students", and "student retention" were ranked the lowest, respectively.

Consistency of research findings with those of other researches

Given the research background, this study is consistent with some of the domestic and foreign researches such as the research conducted by Haghshenas et al (2007), Ehsan Yuksel and Matin Dagdivairen (2010) which in terms of methodology and working procedure are similar to this study but in terms of choice of criteria corresponding to the understudy context differ from it. At any rate, this research differs from some of other researches in the following respects:

- Detail view of the present research in choice of criteria, ...
- Taking account of outlook and mission of the understudy university in all stages

Suggestions

Considering the experiences built in this study and the observed limitations, the following suggestions are offered to future researchers:

- For optimum execution of the questionnaire, drawing attention of organization's top officials and holding a briefing session for the questionnaire fillers in presence of the officials facilitates access to more real information.

- To make the relevant researches in this area applicable, it is suggested the effect of each constituent of organization performance assessment to be applied to similar organizations.
- Future researchers are recommended to select a number of similar organizations for design of a model which is applicable to other similar organizations, given their outlook and mission.
- Considering the multiplicity of the associated areas to medical schools, investigations in other relevant fields such as health care and pharmaceuticals are recommended.
- The people with relatively high skill and knowledge on managerial issues and organization performance should be chosen for interview.

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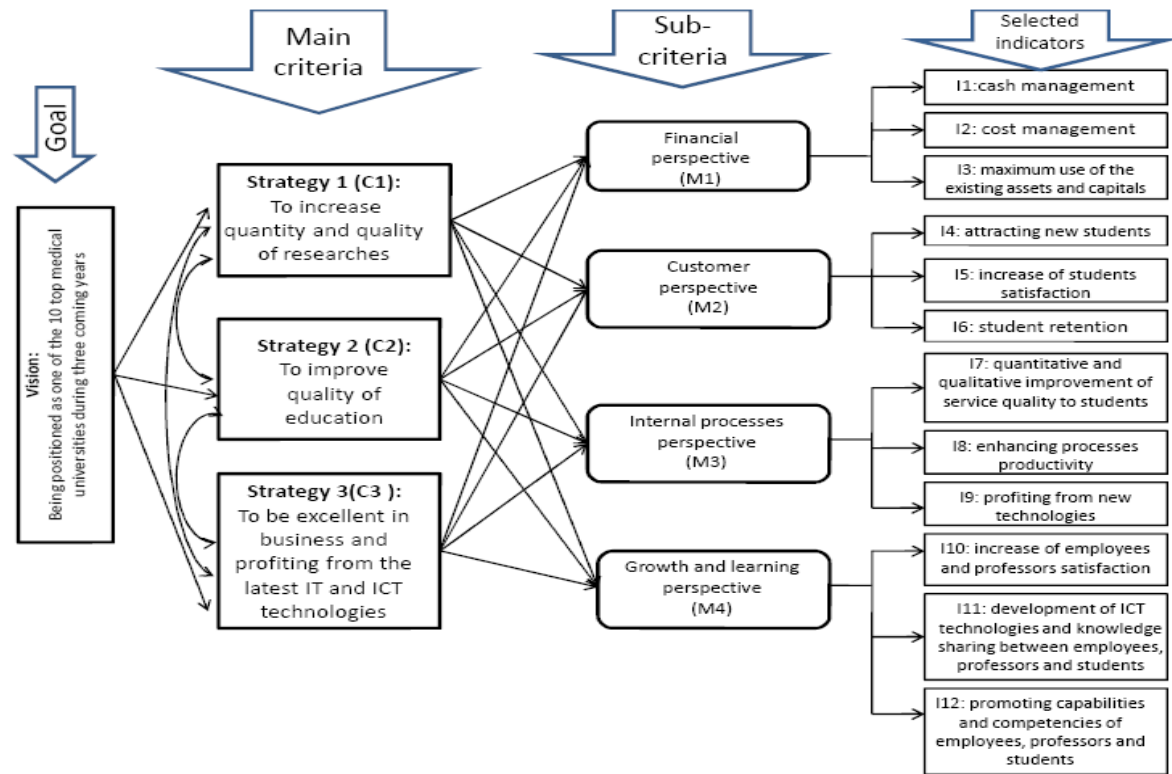


Figure 1: Research Model

Table 1: final weight and rank of the selected indicators based on Fuzzy ANP

code	Indicator	Weight from restricted matrix	Rank in group	Final rank
I1	Liquidity (cash) management	0.08532	1	7
I2	Cost management	0.07597	2	8
I3	Maximum use of asset, capital and inventories	0.06246	3	10
I4	Attraction of new students	0.03191	2	11
I5	Increase of students satisfaction	0.09434	1	5
I6	Student retention	0.02743	3	12
I7	Quantitative and qualitative development of service provision to students	0.12486	1	2
I8	Increase of processes productivity	0.06879	3	9
I9	Use of new technologies	0.09088	2	6
I10	Enhancing employees and teachers satisfaction	0.13535	1	1
I11	Development of communication technologies, participation and knowledge sharing between employees, professors and students	0.10595	2	3
I12	Developing competences in employees, professors and students	0.09676	3	4

Table 2: Final weight and rank of sub-criteria based on Fuzzy ANP

Code	Sub-criteria	Weight	Ranking
M1	Financial perspective	0.25	2
M2	Customer perspective	0.23	3
M3	Internal processes perspective	0.35	1

M4	Growth and learning perspective	0.17	4
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Table 3: Final weight and rank of strategies based on Fuzzy ANP

Code	Strategy	Weight	Ranking
C1	Strategy of research activities qualitative and quantitative increase	0.31	2
C2	Strategy of education quality improvement	0.35	1
C3	Strategy of excellence in business and profiting from latest IT and ICT technologies	0.33	3

Table 4: Cheng and Yang Huwang verbal scales

Relative importance verbal scale	Respective Fuzzy scale
Very strong	1
Strong	0.75
Moderate	0.5
Weak	0.25
Very weak	0

Table 5: Quantitative performance measurement using the combined model of BSC and ANP

Code	Indicator	Weight from limited matrix	Equivalent value of corresponding verbal scale	Organization performance (weight x value)
I1	Liquidity (cash) management	0.08532	0.5	0.042
I2	Cost management	0.07597	0.75	0.056
I3	Maximum use of the existing assets and capitals	0.06246	0.5	0.031
I4	attracting new students	0.03191	0.5	0.015
I5	Increase of students satisfaction	0.09434	1	0.094
I6	Student retention	0.02743	0.5	0.013

I7	Quantitative and qualitative development of service provision to students	0.12486	0.75	0.093
I8	Increase of processes productivity	0.06879	0.75	0.051
I9	Use of new technologies	0.09088	0.5	0.045
I10	Increase of employees and professors satisfaction	0.13535	0.75	0.101
I11	Development of ICT, knowledge sharing between employees, professors and students	0.10595	0.5	0.052
I12	Development of capabilities and competence in employees, professors and students	0.09676	0.25	0.024
Σ	Sum of organization total score	-	-	61.6%