A decision model for selecting of strategic plans in Balanced Scorecard model: A case study for a manufacturing firm

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Abstract: The Balanced Scorecard (BSC) has been proposed as a strategic management evaluation system recently. Strategic management is important for organizational success and competitive advantage in an increasingly competitive business environment. Many organizations have adopted the BSC to gain business excellence and success in the marketplace. It is a practical tool for designing operational strategies. However, the BSC model has some drawbacks and problems which disable to identify the priorities in strategic plans (Initiatives). In this paper, the strategic plans is identified, using a simple additive weighting (SAW) decision model. Also, assessing and determining the strategic plans is developed in the BSC model, using expert panel opinion and SAW method. The results showed that the proposed model is more valid and acceptable and the experts verified the model for selecting strategic plans in the BSC in practice. The developed model has been used in a real case study and the results have been analyzed from different points of view. In this article initiative is called strategic plans.

1. Introduction

Companies have always found it hard to balance pressing operational concerns with long-term strategic priorities. The tension is critical: world-class processes will not lead to success without the right strategic direction, and the best strategy in the world will get nowhere without strong operations to execute it [1]. Regarding the importance of strategic planning in organizations and creating competitive advantage in them, today organization are moving in a competitive, and complex environment and there is a transaction among them. Senior managers and those who are seeking a comprehensive picture of the present situation of a company and a clear understanding of its future image, need information more than standards in financial operations to assess the strategic operations and long-term view of the company and also to achieve operational strategies.

Various kinds of tools are offered for this process, the BSC is a suitable tool for evaluating and designing operational strategies. This tool was introduced by Kaplan and Norton in 1992, [2-4]. The BSC is a conceptual frame work and its function is to translate strategic objectives of a company into a set of operational attributes. These indices are usually selected from four perspectives including financial, customer, internal processes and learning and development perspectives [3, 5]. Many attributes are used for the advancement of a company in the

direction of its perspective. Some other attributes are applied for the evaluation of company development in accessing to long-term objectives. Furthermore, the BSC helps the managers to identify the lagging and leading attributes in their company. The framework of balances evaluation model is shown in figure 1[3].

Furthermore, the BSC has rapidly changed to be prevailing in another aspect of management researches, such as organization studies operations management and information systems. The causes for this quick increase to prevalence are clear; there is the request of simpleness. No longer do managers have to work their way through heaps of statistics, but they can keep track of a few key indicators instead. [6-9].

However, we have some progressions and successes in areas of introducing and applying of MCDM in the BSC, the current methods have problems and weaknesses for determining strategic plans and it is necessary to develop models by establishing more researches. Since, the BSC model has some drawbacks and problems which disable it to identify the priorities in strategic plans. According to problems and weaknesses for assessing and identifying strategic plans in the BSC, SAW method enables a simple and a low cost assessing for manger and assessor to aid companies in better assessing and recognizing strategic plans.
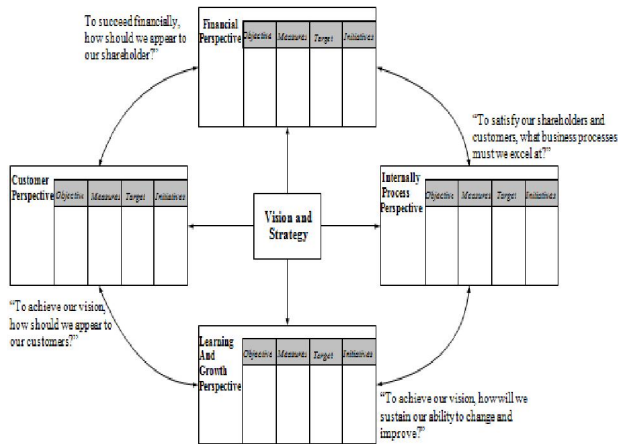
Figure 1. Balanced Scorecard model [2]

Since the modeling of SAW for priority and selecting of strategic plans in the BSC is in essence non-existent, the objective of this paper is to propose a SAW decision making model for selecting the strategic plans in the BSC. This study has several particular contributions comprising:
1. Determining the explicit criteria regarding the financial, customer, process, learning and growth aspects of the BSC, gap analysis, achieving to strategic plans and objectives of organization.
2. Using Multi Attribute Decision Making (MADM) approach for selection of strategic plans in the BSC model.
3. Employing the SAW decision model for priority of strategic plans in the BSC model.
4. Applying a simple and a low cost model for priority of strategic plans in the BSC model.
This paper proceeds as follows. In Section 2, the literature of the BSC and the MCDM is reviewed. The material and methods and results are discussed in Sections 3 and 4, respectively. Finally Section 5 provides discussion and conclusion.

2. Literature review
The BSC is a new tool for designing operative strategies (translate strategy into action). This model offers a way for a corporation to gain a wider perspective on its strategic decisions by considering the impact on finances, customers, internal processes and employee learning. The analysis takes financial and no financial measures, short-and long-term goals, external goals, internal improvements, past outcomes and ongoing requirements into account as indications of future performance [2-4].

Table 1. A summary of studies in the areas of BSC and MCDM

Research title	Purpose
Multidimensional assessment of organizational performance: Integrating BSC and AHP[12]	This study integrates two tools, BSC and AHP, to provide a better assessment of the relative performance of three organizational units within a Brazilian telecommunications company.
A fuzzy AHP and BSC approach for evaluating performance of IT department in the manufacturing industry in Taiwan [7]	This paper proposes an approach based on the FAHP and BSC for evaluating the performance of IT department in the manufacturing industry in Taiwan.
Applying fuzzy balanced scorecard for evaluating the CRM performance	This paper aims to provide a framework for evaluating impact of implementing CRM based on BSC using fuzzy TOPSIS and SAW.
The Assessment of Military Project Alternatives between Dry Dock and Slipway in Taiwan's Navy[13]	To proposed a new "Vote-Ranking" method to BSC analytic process to assess MCDM combined with DEA, BSC and AHP
The comprehensive evaluation of railway freight enterprises' performance based on the balanced scorecard card and AHP [14]	To propose a methodology for railway freight business' performance assessment based on BSC using AHP and TOPSIS
Using Topsis Method with Goal Programming for Best selection of Strategic Plans in BSC Model [15]	To propose a methodology for selecting of strategic plans in BSC using TOPSIS and GP
Using Multi-Attribute Decision Making For Designing Revised Balanced Scorecard In National Iranian Oil Products Distribution Company [16]	To propose a approach for evaluating oil company using AHP and SAW
Multi criteria quality assessment of products by integrated DEA-PCA approach [17]	The objective of this study is to analyse and assess multi criteria quality of products by an integrated multivariate approach. The integrated multivariate method is based on DEA, principle component analysis (PCA) and numerical taxonomy (NT)
Ranking of Strategic Plans in Balanced Scorecard by Using Electre Method [18]	To proposed a method for selection of strategic plans in BSC using Electre which is one of the MCDM model
A fuzzy multi-objective balanced scorecard approach for selecting an optimal electronic business process management best practice (e-BPMBP) [19]	The paper proposes a novel fuzzy group multi-objective method for e-BPMBP evaluation and selection.
Priority of strategic plans in BSC model by using Borda method [20]	To proposed a method for selecting strategic plans in BSC using Borda
R&D project evaluation: An integrated DEA and balanced scorecard approach [21]	To propose a methodology for R&D project evaluation based on BSC using DEA

The term of the BSC is aimed to maintain a balance ''between short- and long-term objectives, between financial and non-financial measures, between lagging and leading indicators, and between internal and external performance perspectives'' [10]. The BSC's four performance perspectives are including a traditional financial performance group of aspects, non-financial performance measurement indicators customer, internal business process and learning and growth. The four perspectives are described concisely (figure 1) [10].

2.1. Simple additive weighting (SAW)

The SAW which is also known as weighted linear combination or scoring method is a simple and most often used multi attribute decision technique. The method is based on the weighted average. An evaluation score is calculated for each alternative by multiplying the scaled value given to the alternative of that attribute with the weights of relative importance directly assigned by the decision maker followed by summing of the products for all criteria [11]. The SAW decision model is a simple and low cost model for selecting of strategic plans in the BSC. Therefore it could be a suitable tool toward modeling of the BSC. Table 1 summarizes the recent reviewed research papers in the area of the BSC and the FMCDM.

3. Material and Methods

3.1. Experts group and strategic plans weights

The MCDM problem has some objective that should be recognized by DMs. All MCDM methods require information that should be gained based on relative importance of the objective. Objective weights can be allocated directly to objective by a DM group or by scientific methods. These weights specify relative importance of every objective.

Usually groups are classified based on their different levels in social status, knowledge and work experience. So every factor in special subject that causes increase or decrease of an idea's weight should be considered. In this regard, allocating different weights to opinions considering their knowledge and experience in relation to that subject seems necessary. Our study uses hierarchical objectives for identifying of strategic plans weights. For this process, the study needs to determine the weights of perspectives and sub perspectives using expert opinions. The final weights of sub perspectives (financial, customer, internal processes and learning and growth) were determined using the geometric average method [22].

3.2 Algorithm of strategic plans selection in BSC

In this section, model inputs, processes and output which are selected by strategic plans are systematically outlined. In the subsequent flowchart (Figure 2), the components of accomplished algorithm have been depicted. On the basis of algorithm of modeling process for selecting strategic plans in the BSC, different phases are explained as follows.
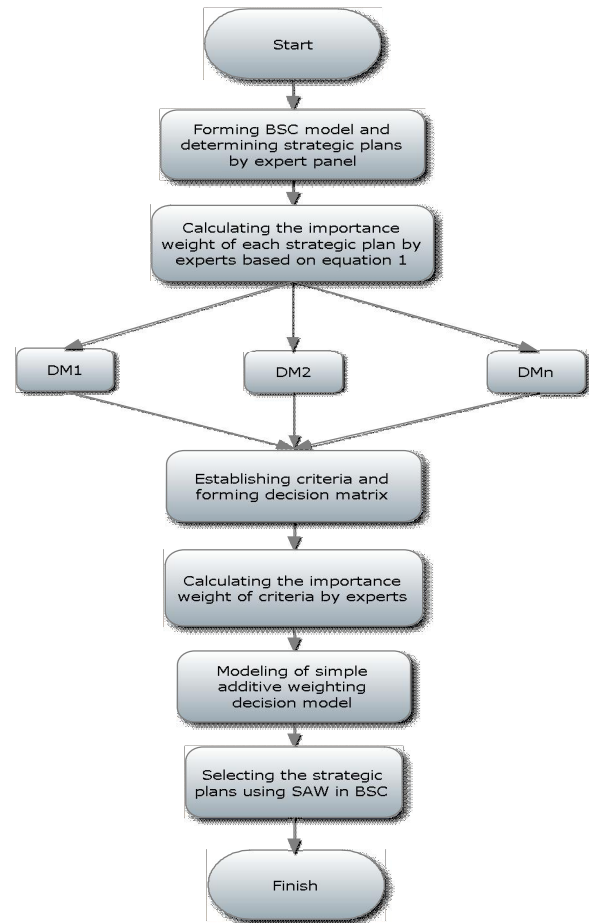

Figure 2. Modeling Process

Phase1. Forming BSC Model

Based on data and information, experts panel are formed the the BSC model including objectives, measures, targets and strategic plans (initiatives) in four perspectives comprising financial, customer, internal business process and learning and growth. Members of the experts' panel who have significant information about strategic direction of a company are chosen. There are several methods such as Delphi or Nominal Group Technique (NGT) which can be used to identify the strategic plans based on experts opinions.

Phase 2. Calculating the importance weight of strategic plans

In terms of experts' opinions, the importance weights of four perspectives are calculated. Then the importance weights of strategic plans are computed based on geometric average method.

Phase 3. Establishing criteria and forming decision making matrix

Expert panel by the NGT method determines the strategic plans. They have consensus for establishing criteria and forming decision making matrix. Four criteria are defined by expert panel and based on their knowledge and experience as follows.

1- Importance criterion: importance criterion is the degree of the weight or importance of each strategic plan for the organization and this importance (weight) is defined by expert opinions and their knowledge and experience.

2- Gap criterion: the concept of gap is distance between the present situation and desirable situation. In this sense, the more gap of the present situation compared with the desirable situation in the organization, the more importance for the organization. Also it should be performed as soon as possible. Indeed, gap is the distance between measure and target in the BSC model.

3- Cost criterion: generally, organizations have limitations in budgetary and financial resources; consequently, we are looking for cost of strategic plans and whether the organization can perform them with regards to these limitations.

4- Time criterion: regarding the performance time of each strategic plan is different from the others, shortness of strategic plan performance time leads to achievement of the organizational objectives faster and vice versa.

Phase4. Modeling of simple additive weighting

The advantage of SAW method is a proportional linear transformation of the raw data which means that the relative order of magnitude of the standardized scores remains equal. Process of SAW describe as follows [23].
Based on Phase 3 experts have consensus for establishing criteria and forming decision making matrix by the NGT method. The normalized decision matrix is calculated as equation 1.

$$n_{ij} = \frac{a_{ij}}{\sqrt{\sum_{j=1}^{m} a_{ij}^2}}$$

$$(1)$$

Regarding on the normalized decision matrix which has four criteria and 12 strategic plans, the BSC model is formed. Evaluate each alternative (strategic plans), Ai by the following formula:

$$A_i = \sum W_j * X_{ij} \qquad (2)$$

Where xij is the score of the ith alternative with respect to the jth criteria, wj is the weighted criteria [11].

Ultimately, with regards to last step which determined the utility of strategic plans using simple additive weighting decision model subsequently, the strategic plans in the BSC are ranked.

4. Results

A case study was conducted in the electronic and computer research center of a university which is active in the field of producing industrial high capacity monitoring systems. Four experts consisting of the director manager, commercial manager, financial manager and production manager were selected and their opinions based on four BSC perspectives and four strategic objectives were taken for each perspective and the result were shown as follows.

Regarding phase 1 and considering experts panel of electronic and computer research center, the BSC model was formed as illustrated in table 2. In the table initiatives equal to strategic plans which were determined by the expert panel.

Based on phase 2, using the consensus of expert's opinion, the importance of BSC's objectives are determined, which are related to each perspective in the BSC. Then using the geometrical average weights of the final objectives in four perspectives (financial, customer, internal process and human resources) is calculated.

Based on Phase 3, experts have consensus for establishing criteria and forming decision making matrix with regards to table 2 by the NGT method. The decision matrix has been normalized regarding to the relation (1) and phase 3. Considering consensus of expert panel and phase 4, weighting of criteria is computed.

Ultimately, with regards to relation 2 which determined utility of strategic plans using simple additive weighting decision model subsequently, the strategic plans in the BSC are ranked as follows.

I1 >> I7 >> I3 >> I4 >> I6 >> I9 >> I12 >> I10 >> I11 >> I8 >> I2 >> I5

Table 2: Balanced Scorecard model for electronic and computer research center

Financial			
Objectives	Measures	Target	Initiatives
Income increasing	0.7	0.9	I1-Marketing Research
Profit increasing	0.8	0.9	I2- Marketing
Cost reduction	0.10	0.05	I3- ABC
Customer			
Increasing customer satisfaction	0.8	0.95	I4-After sales Services
Increasing market share	0.60	0.75	I5- Marketing Research
Increasing added value for customers	0.75	0.90	I6-Value Engineering
Internal Processes			
Objectives	Measures	Target	Initiatives
On time delivery	0.65	0.80	I7- Time & Motion Study
Product development	0.65	0.69	I8- QFD
Continuous improvement	0.75	0.85	I9- TQM
Learning & Growth			
Increasing employees satisfaction	0.65	0.80	I10- increasing personnel salary
Increasing employees productivity	0.55	0.70	I11- personnel evaluation system
Increasing informational skills	0.70	0.85	I12- MIS

5. Discussions and Conclusion

In conclusion, the BSC model is the most important approach for assessing strategic planning and diagnosis of organization. It is a practical tool for designing operational strategies. However, the BSC model has some drawbacks and problems which disable it to identify the priorities in strategic plans (Initiatives). In organizations with limitations of time, budget and resources, they cannot implement all the strategic plans. In this condition, some standards or indexes and limitations should be defined for prioritizing and choosing the strategic plans. Hence, we need the knowledge and experience of expert panels and strategists of an organization for determining the criteria and strategic plans. Since there is no simple and low cost method of selecting the strategic plan in the BSC. The SAW decision model solve some these drawbacks and problems in the BSC in practice. The presented model has been implemented in a manufacturing firm which is active

in the field of producing industrial high capacity monitoring systems and revealed more reliable and acceptable results in practice. Moreover, the proposed model in this research has some features including, the explicit criteria regarding the financial, customer, process, and learning and growth aspects of the BSC, gap analysis, achieving to strategic plans and determining the objectives of organization. The MADM approach for selection of strategic plans in the BSC model was used. The SAW decision model for priority of strategic plans in the BSC model was employed. Simple and low cost model for priority of strategic plans in the BSC model was applied. The model can be extended to be used for any number of inputs, where expanding the classic models to more inputs is not an easy task. This methodology provides more informative and reliable analytical results. It also facilitates rapid decision making for managers. The model can facilitate systematic designing of operational strategies; it provides the means for manager to devise selecting strategic plans. Further research is necessary to develop other models and compare the efficiency of different models for best selection of strategic plans in the BSC.

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