A NEW ALGORITHM FOR EVALUATION OF THE BALANCED SCORECARD THROUGH AN AHP

A Case Study for Electronic Commerce B2C

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Abstract: The development of research based on the implementation of the Balanced Scorecard (BSC) and management control in a company has become an important venue in search of better control founded on the vision and mission of the company. The breakthrough of the BSC is an increase in the quality and reliability in implementing the Strategic Objectives, which are made pursuant to each of the perspectives that manages the BSC, and from management point of view and increases security ease in the responses to the changes occurring in the sector in which the company operates. However, it has been found in the literature for concluding a job which is the best alternative for the construction of the BSC for Electronic Commerce and less an investigation to assess the BSC in this type of commerce. In this paper an algorithm is constructed for the purpose of evaluating the indicators that are implemented in a BSC, in order that the organization is clear which should focus on for better control. Given this algorithm is applied to a generic BSC for Electronic Commerce by way of illustrating the implementation of the methodology proposed in this paper.

1 INTRODUCTION

The advent of Internet has created a new concept in the field of economics where there is the possibility of buying and selling products. In practice, companies are beginning to use the Internet as a new sales channel, replacing personal visits and telephone for electronic orders, and to make an order online to do it the traditional way. This advantage and others mentioned have caused a rapid deployment of electronic business (e-commerce) and became a key point of economic importance to businesses today. The e-commerce (EC) offers a wide range of solutions among them are: 1) improve business processes using Internet technologies, 2) use the Web to bring together customers, vendors, suppliers and employees in ways never before possible, and 3) The process of enabling a business to sell products, improve customer service, and maximizing the results of limited resources (Raisinghani et al., 2004).

Given that the benefits offered by the e-commerce are complex by Benser`s nature measure (Bremser and Chung, 2005) establishes the need to use metrics for e-commerce to enable firms to measure their performance. Similarly Grembergen (Grembergen and Amelinckx, 2002) proposes a method for carrying out the measurement and management in electronic commerce.

This paper presents a methodology that allows prioritizing the strategic objectives of a company that uses the EC under the Balanced Scorecard BSC approach (Durrani et al., 2000), through a multi-AHP method, which allows use qualitative variables which are evaluated by a peer group for this particular investigation to be counted supporting documents that the author used to assist in the assessment of the prospects of the BSC, the case for an assessment corresponds to an analysis of a BSC for e-commerce.

2 METHODS

Below is a description of the operation and the aspects to take into account the methods used in this research:

A. Multicriteria Technique

The Analytical Hierarchy Process (AHP) development by Saaty (1980) is introduced for

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choosing the most suitable alternative that meets all the objectives of multiple attributes in making decisions for a particular problem. AHP allows a series of complex analytical issues, in which comparisons are made taking into account the importance of each item according to the impact that has on the solution of the problem based on three principles: decomposition, comparative judgments and synthesis of priorities (Chamodrakas et al., 2009) (Saaty, 2007).

For this work we have adopted the technique of multi-criteria decision analysis for AHP-based evaluation framework for the selection of the most important perspective on the Balanced Scorecard.

The AHP method was selected for the development of this document for the reasons explained below. First, the AHP is a system for analysis, synthesis and reasons for making complex or subjective decisions such as those characterized in the Balanced Scorecard. Secondly, based on pairwise comparison judgments, AHP integrates both criteria importance and alternative preference measures into a single overall score for ranking decision alternatives. Third, the AHP provides an overarching view of the complex relationships inherent in the problem and helps the decision maker assess whether the evaluation criteria are of the same order of magnitude, so the decision maker can compare such homogeneous alternatives accurately, and you can focus on objectives rather than on alternatives, and offers numerous advantages, as a synthesis of mechanism in group decisions (Lee and Kozar, 2005).

The calculation process can be briefly described as follows:

1. AHP algorithm: AHP uses comparative measurements of 1-9 and builds the initial matrix, taking into account any of the aspects described below (Chamodrakas et al., 2009) (Saaty, 2007):

The first is to compare directly, and give a final criterion, and define which of the two most important elements according to established criteria.

The second is to compare indirectly, in relation to a criterion and select the item that has more weight to the criterion; this is recommended if you want to take into account the AHP technique.

a. Calculations: It assumes that there are criteria $P_1, P_2, ...P_m$ in the level of control, and that elements $C_1, ...C_N$ levels of the network, C_i has elements $e_{i_1}, e_{i_2}, ..., e_{i_m}, i = 1, 2, ..., N.$

1) Matrix Structure Proper: The matrix was built with the degree of influence of the group elements; the construction of the matrix weights is the degree of influence of the group, namely the degree of influence among them. Under the criterion of control levels, the construction of the upper matrix and calculation of the normalized vector, it is the characteristics of this matrix:

C_i	$C_1 \cdots C_N$	Normalized Vector
C_1		λ_{i_1}
$\vdots$	Comparison Matrix	$\vdots$
C_N		λ_{i_N}

The weighting matrix is as shown, equation 1:

$$\lambda = (\lambda_{ij})_{N*N} \tag{1}$$

The weighting matrix as a show equation 2:

$$\tilde{W}_{ij} = \lambda_{ij} * W_{ij} \tag{2}$$

The new array is written by $\tilde{W}$, and for all 0-1 on the line. For each factor shows the degree of influence between the elements. If it exists, between them, arranged one by one, and each line is the same:

$$A = \begin{pmatrix} a_1 & \cdots & a_1 \\ \vdots & \ddots & \vdots \\ a_z & \cdots & a_z \end{pmatrix}$$

Where:

$$z = \sum_{i=1}^{N} n_i \tag{3}$$

This can be abbreviated as:

$$\tilde{A} = \begin{pmatrix} a_1 \\ \vdots \\ a_z \end{pmatrix}.$$

Each factor is expressed under the weight of the criterion.

2. *Balanced scorecard:* The Balanced Scorecard, measures both the object of financial accounting and long-range competitive capabilities of the organizations: investment in customers, suppliers, employees, processes, technology and innovation and provides executives with a structure and a language to communicate the mission and strategy. The measurements are used to inform employees about the causes of the current and future success and as a tool for translating the vision and strategy into a coherent set of performance indicators. (Lara, 2004)

So far Grembergen (Grembergen and Amelinckx, 2002) within the literature studied is the only one who has raised a Balanced Scorecard

(BSC) for generic e-commerce. His research is purely theoretical, does not apply any technique or show step by step how they can apply BSC firms when they want to venture into e-commerce or on the contrary the companies already using it, while on the contrary Durrani (Durrani et al., 2000) shows a step by step process which illustrates an approach to the development of technology strategy, using the benefits of the BSC, and finally Yuksel (Yuksel and Dagdeviren, 2009) determine the performance level of a business on the basis of it is vision and strategies, by integrating BSC approach with fuzzy ANP technique "posed by Chang (1992,1996)".

Given the above, this document is taken as reference BSC developed by Grembergen (2002) and be conducted step by step process to be followed by employers in the construction of the BSC and shown the algorithm to develop the AHP (Saaty 1980), which generate a methodology for evaluating the Balanced Scorecard using an AHP, which can be adjusted to any company that is part of e-commerce.

3 METHODOLOGICAL PROPOSAL BSC

Here are the steps to follow to implement the *Balanced Scorecard* and assessment should be undertaken at this using the AHP.

Step 1, Establish the mission and vision of the company which will handle the administrative team, who are experts in the business.
Step 2, Realization of the strategic objectives, which allow to easily visualizing highly graphical and business strategy
Step 3, Definition of indicators according to the strategic objectives
Step 4, Structure the BSC taking into account the vision, mission, strategic objectives and indicators.
Step 5, The weights are set of indicators in each perspective, for comparative measurements including measurements for these weights are set between 1-9, where a score of 1 represents equal importance between the two elements and a score of 9 indicates the extreme importance of one element (row component of the matrix) compared to the other column one (part of the womb) (Saaty, 1980) (Sólnes, 2003).
Step 6, Calculate the total weights of the indicators, for the importance of each perspective BSC.
Step 7, Select the best strategy, the indicators with the largest overall priority should be those selected.

The following diagram shows the proposed scheme:

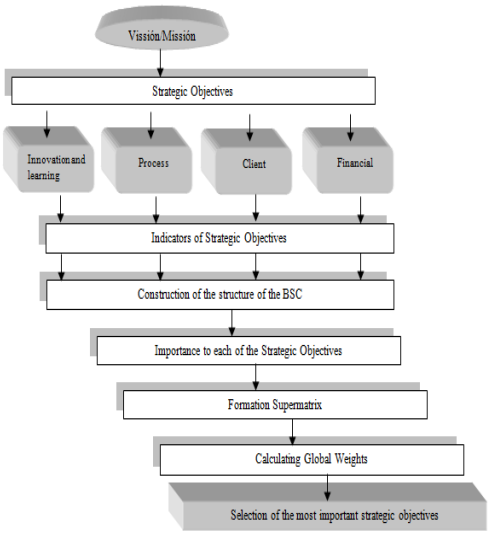

Figure 1: Diagram of the proposed BSC.

4 APPLICATION FOR THE PROPOSED BSC MODEL

For this investigation in which AHP is used to analyze and evaluate the best strategic objective in the BSC, according to the mission and vision established at the outset, the use of a generic BSC for e-commerce, which was developed by Grembergen (2002).

Taking into account the type of trade, the author of Balanced Scorecard generic electronic commerce (EC) provides four perspectives and each builds a mission, so that for purposes of this research will build a vision for the realization model and strategies. Below in Table 1 show the perspectives and indicators:

Table 1: Perspective and performance indicators.

BSC Perspectives	**Strategic Objectives**
Financial	Achievements of the Plan (AP) Business Value (BV) Budget Enforcement (BE)
Client	Customer satisfaction (CS) Customer retention (CR) Acquisition of new customers (ANC) Effective Internet Marketing (EIM)
Internal Business Processes	Process compliance (PC) Availability of EC systems (AECS) Improving the development of the system (IDS) Security & Trust (SET)
Learning and Growth	Gain experience in the CE (GEEC) Efficiency of the management business in the EC. (EMB) Independence of the consultants (IC) Reliability of software vendors (RSV)

In the Figure 2, observed the Analytical Hierarchical Model for the BSC in the EC:

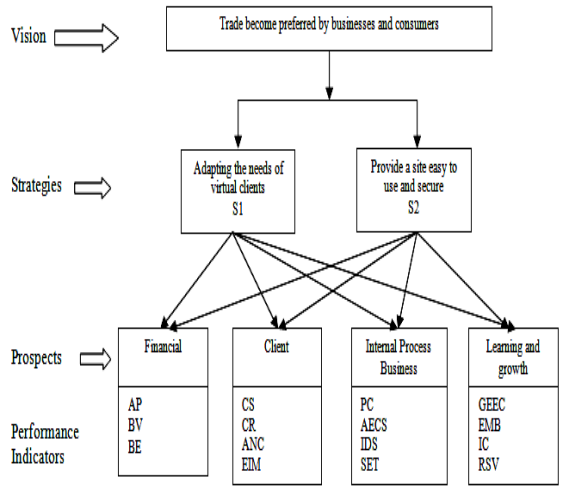

Figure 2: Hierarchical Model BSC in the EC.

5 RESULTS

The calculations shown below were made in the software developed by Saaty SuperDecisions®, this software allows the performance of calculations in a much more practical and safe. A table below shows the results obtained:

Table 2: Weights of the indicators.

	Learning and Growth				Internal Business Processes			
	GEEC	EMB	IC	RSV	PC	SET	AECS	IDS
S 1	0.12	0.06	0.02	0.03	0.04	0.08	0.03	0.07
S 2	0.11	0.06	0.02	0.04	0.04	0.11	0.02	0.05

	Financial			Client			
	BV	BE	AP	CS	CR	EIM	ANC
S 1	0.11	0.04	0.09	0.03	0.04	0.05	0.12
S 2	0.10	0.03	0.11	0.05	0.06	0.02	0.10

Table 2, shows the data corresponds to step 5 and 6 set out in the methodology which resulted in final weights of each perspective of the two strategies.
Given that by normalizing the most important strategies is "Adapt to the needs of virtual customers" with 56%. In Table 3 we see step 7 of the proposed methodology, in which we obtain the standardized weights of the strategy according to the proposed model, had the highest percentage of importance after applying comparative measures between the indicators of each strategy.

Table 3: Standard Values Of The Indicators.

	Value Standard		Value Standard
Financial		Learning and Growth	
BV	0.42	GEEC	0.46
BE	0.13	EMB	0.26
AP	0.44	IC	0.09
		RSV	0.17
Client		Internal Business Processes	
CS	0.19	PC	0.19
CR	0.24	SET	0.44
EIM	0.11	AECS	0.10
ANC	0.44	IDS	0.25

Table 4: Priority indicators in every perspective.

	Value Prioritized		Value Prioritized
Financial		Learning and Growth	
AP	0.11	GEEC	0.11
BV	0.10	EMB	0.06
BE	0.03	RSV	0.04
		IC	0.02
Client		Internal Business Processes	
ANC	0.11	SET	0.11
CR	0.06	IDS	0.06
CS	0.04	PC	0.04
EIM	0.02	AECS	0.02

The most important strategy Indicators selected in this example, as shown in Table 4, are: Achievements of the Strategic Plan, Acquisition of New Customers, Security and Trust, and finally, gain experience in Electronic Commerce.

6 CONCLUSIONS

This paper presents a methodology for the evaluation of the indicators for each perspective of BSC, in order to prioritize the indicators that will show which are most relevant when assessing the status of the company is in Electronic Commerce. The application developed is made taking into account a generic BSC, which was proposed by Grembergen (2002), resulting in indicators that are key to the control that should lead the company

when deciding to offer their products / services this type of commerce.

Finally, in order to explain the algorithm through a B2C resulted in the best strategy for the study was "Adapt to the needs of virtual customers", demonstrating that the proposed algorithm becomes a good tool to achieve the goal exposed in this investigation.

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