

Integration of Health and Safety at Work and Environment perspectives in the Balanced Scorecard

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Abstract

The balanced scorecard is an effective tool for the evaluation and monitoring of financial and non-financial performance (customers, internal processes and organizational learning) within companies. It allows transforming the company's vision and its strategy to operational, measurable, and manageable indicators. However, this tool hasn't taken yet into account the aspects of health, safety, and environment at its outlook appearance. This paper propose a strategy to integrate health, safety, and environment indicators to the new Balanced Scorecard by explaining the cause and effect relationship between its six perspectives using the DEMATEL approach (Decision Making Trial and Evaluation Laboratory).

Keywords

Balanced Scorecard, health and safety, environment, DEMATEL.

1. Introduction

The assessment of industrial performances constitutes a high priority for enterprises; it is an essential operation to ensure an effective control. However, it remains a difficult task to achieve due to the multitude of services and complexity of the use of information which are supposed to be collected.

Before the 90s, most methods of performance's measuring were based only on the financial axis (outcome indicators were privileged). However, the competitive environment has forced companies to change the way they evaluate performance. They moved from a strategy of low-cost production to a production based on quality, flexibility and respect of the implementation period (Slewart, 1995 Kennerley and Al. 2002 Gunasekaran and al. 2001, speaking in 2000, Kaplan 1990). Therefore, performance measurement methods more adapted to the context of intense competitiveness have emerged.

At the beginning of the 90s, the concept of performance indicators system has appeared. Indeed, many contributions have been proposed. Nowadays, more than ten methods are available in the literature (Welsh, 1990 and Vincent, 2004). Among these methods, we choose the Kaplan and Norton Balanced Scorecard (BSC) and we discussed the idea of reconciling the BSC with sustainable development in terms of environmental and observation of health and safety at work.

To develop this idea, this paper will be presented as follows: Section 2 is devoted to introduce the Balanced Scorecard. In Section 3, we define the benefits of integrating the two axes: health and safety at work and environment in the BSC. The section 4 is consecrated to present the BSC's new architecture. In the last section, we

will detail the methodology followed to establish the causes and effects relationship between the elements of the BSC's new architecture by using the DEMATEL method.

2. The concept of Balanced Scorecard (BSC)

2.1 Overview

The Balanced Scorecard (BSC) is a management concept that focuses on the strategy and vision rather than control by providing the tools to transform the vision of an organization into concrete actions.

A definition of the balanced scorecard could be as follows: "A dashboard that processes all dimensions of a company without limitation to financial aspects. Its goal is to transform strategic vision into concrete actions". Indeed, the scorecard is not just a dashboard, but also a method allowing the company to move from defining its strategy to conducting its concrete implementation through the definition; following four axes (financial, customer, process, learning); the strategic objectives associated, causes to effects tree between these objectives, actions to develop ... In addition, it must allow better transmission of this strategy to all collaborators of the company and make them actors of its success (webmaster, 2008).

The scorecards are designed to rebalance the traditional approach of evaluating performance by adding to the usual financial performance axis ("What shareholders see": profitability, value added, etc.) three other axes that include other dimensions of performance that are: "clients", "internal processes" and "organizational learning" (webmaster, 2008).

2.2 Perspectives of the BSC

Kaplan and Norton have considered four different perspectives for a complete evaluation of an organization (Kaplan & Norton, 2000):

- **The customer perspective: How are we perceived by our customers?**

In other words: how do we create value in the sense of customer to achieve the financial objectives?

Improving customer profitability is a must to all forms of growth. Whether an increase in revenue generated by each customer and segment, or by customer growth, we must search for tracks. This axis' indicators are generally oriented toward assessing the satisfaction and loyalty of customers, the extent of customer growth and increased profitability per customer...

- **The internal process perspective: What are the key internal processes to success?**

In other words: What are the processes that deserve our "care" at all times to satisfy customers and shareholders.

The quality of services delivered to customers is directly dependent on the performance of the process. It is important to identify the key processes that can improve supply and consequently profitability served to shareholders. This category includes all closely contributing to the creation of process values without omitting the longest cycle processes such as those related to innovation.

- **The learning and growth perspective: how to organize our ability to progress?**

With the last two books "Strategy Maps" and "alignment", the two authors have a little inflected this formulation: How to align the people, systems and culture to improve critical processes?

To achieve the long term goals, it is essential to restore the infrastructure. This axis covers three sections: men, systems and procedures. The progress measure focuses on training people to access new skills, improving the information system and the matching procedures and practices (Fernandez Nodas way, 2014).

- **The financial perspective :**

The measurement of financial performance indicates whether the company's strategy, its implementation and enforcement contribute to the improvement in net income (bottom-line) (Chytas, Glykas, Valiris, 2011). The financial perspective includes three important measures for shareholders. Return on investment and cash flow reflect the preference in the short term, while the reliability of forecasts indicates the will of the parent company to reduce the historical uncertainty associated with the change in unexpected performance. Finally, the project's profitability is focused on the project as the basic unit for planning and control, while the order backlog reduces the performance of uncertainty (Kaplan & Norton, 1993).

Every axis includes strategic objectives to be correlated to describe the company's strategy. Rebalancing is also carried out between performance and "advanced" indicators. While the first measures the result of an action, a realization in relation to an objective, the second can track key policy variables to influence the final performance, instead of just the note.

Finally, these dashboards are wanting prospective: they rebalance the relative importance of short-term goals (such as financial performance) and the long-term goals, focusing on what the leaders want from their organization. They are also prospective because they ascend from effects to causes (e.g. internal organization). By doing so, they can improve the future effects (e.g. the financial results in the case of a company) (webmaster, 2008).

2.3 The strengths and weaknesses of the BSC

- **The strength's points**

The Balanced Scorecard offers a new way of management and control of the company relying on the establishment of a rigorous framework for the development and deployment of the strategy guaranteed by the permanent balance of the four pre-cited prospects. This is to highlight and control relationship between causes and effects. This is the real key of the method (Fernandez Nodesway, 2014) and it particularly encourages managers to better understand the multiple dimensions of performance.

The financial indicators are counter-balanced with customer, processes and growth dynamic oriented indicators. The integration of dynamic growth outlook is also one of the strengths of the method (Fernandez, 2016). However, there are also gaps in this method which we will list in the following paragraph.

- **The weaknesses' points**

One of the first gaps in the BSC is the choice of the title of this concept. In the French version of Norton and Kaplan's book, the title of the original concept, which is "Balanced Scorecard" was clumsily translated as "prospective dashboard." Although the concept aims to anticipate the future business performance, the forecasting and predictive dimensions of this concept doesn't appear in the original title. A precise and accurate translation of the English title was "Balanced dashboard". However, the "balanced" term was not accepted because it would make the Classic Dashboards not classic any more.

A lack of clearness about the differences between the political and strategic dimensions. The fulfillment of a mission or the realization of a vision has a strong political connotation, while achieving an objective implies a consideration of strong economic criteria (Juglaret, 2012).

Moreover, the choice of four strategic axes proposed by default is questionable (financial perspective, customer perspective, internal process and organizational learning perspectives).

The "customer" and "financial" axes match the targets, while the other two axes generally include the means for achieving these goals.

The absence of integration and consideration of any concept or strong theoretical model about the relationships between causes and effects to the implementation of the strategy. Unlike Dashboards "classics" that can be built using methods of translation and the establishment of a strategy (OVAR, Ishikawa, etc.), the causal links between the determinants of performance classified on different axes (customer, internal processes and organizational learning) and financial performance have not been studied by any author (Davis, 1996; Atkinson and Epstein, 2000). Frequently, the causes and effects relationships presented in the book of Norton and Kaplan are linear chains very stereotypical and trivial.

The relation of causes and effects between each axis is not necessarily obvious. Kaplan and Norton seem to forget the interdependent relationships that may appear between each axis (Norreklit 2000). Causal relationships between the determinants of performance on each axis are not necessarily unidirectional. For example, research and development in line classified "organizational learning" depend on the financial health of the company and its

capacity to innovate (financial center). The financial results will depend on the ability to sell products to customers (customer axis).

Finally, if a causal relationship requires an execution time (between cause and producing the effect), this temporal dimension is not mentioned in the concept of Dashboard "prospective" (Norreklit 2000).

However, we can criticize the method about the exclusivity of the Top Down approach. Specifically, the implementation of Balanced Scorecard in companies tends to endorse the pyramidal hierarchical structures (Juglaret, 2012). Therefore, we blame the absence of an axis that deals with health and safety and also the environmental aspect.

In this work, we will focus on the lack of health, safety, and the environment aspects in the BSC, given that they complement the overall management of business performance.

3. The benefits of adding health and safety at work and environment perspectives to the Balanced Scorecard

3.1 The perspective of health and safety at work

According to the European Agency for Health and Safety at Work (EU-OSHA, 2008) the health and safety (OHS) have advantages for the company and they are, in any case, a legal and social obligation. Of course, companies appreciate the fact that the SST contribute in reducing accidents and occupational diseases, but also the fact that it is an essential element of success.

The management of OSH at the enterprise level provides several benefits including:

- Contributes to show that a company is socially responsible;
- Protect and enhance the image and brand value;
- Helps to optimize productivity of the workers;
- Improve employee commitment to the company;
- Strengthen the competence and health of workers ;
- Reduce business costs and disruptions in work;
- Enables organizations to meet customer expectations in terms of safety;
- Encourage workers to stay longer in the workforce.

Each company can derive significant benefit from its investment in Health and Safety. Simple initiatives can improve the competitiveness, profitability, and employee motivation. The implementation of a Health Management System and Safety at work provides an effective framework for preventing or reducing accidents and diseases.

In order to assure a good management, some companies resort to international standards that define requirements to be met by an OSH management system with guidelines for its use. Among its references, we can cite the ISO 45001 (Bouliteau, 2015) and the OHSAS 18001 (Liers and Gabbai, 2009).

According to the previous discussion, it is necessary to consider the OHS component in evaluating business performance and add this component to the BSC to make it a daily monitoring.

3.2 The environment perspective

Today, companies are increasingly subject to continuous pressure to integrate environmental considerations into their strategic management. Due to the intervention of government's authorities to the development of competitiveness related to innovation and the sensitivity increase of the customer, the environmental management systems have changed their policies from the political and moral framework to that of the company.

Environmental management is not limited to a single function, but concerns all the activities of a business, including research & development, logistics, finance and quality. Each department is required to assume the conventional role assigned to it and introduce it in its program of environmental protection measures. Like quality, environmental management cannot be "controlled", but should be rooted in the strategies and business practices.

There are international standards that define requirements to master and reduce the impact of business activities on the environment, such as: ISO 14001 (Lucile, 2015) and EMAS (Environmental Management Audit System) (Bo, 2004).

Therefore, the indicators which measure the environmental impact are needed. That explains the necessity to add this perspective at the BSC.

4. The new architecture of the BSC

The major concern of every industrial organization is to establish a maximum profit with taking into account quality constraints, delay, innovation, environmental, health and safety...

The objective of this study is to broaden the axial base of BSC by adding the environment axis (waste management, gaseous emissions and even noise nuisance) and health and safety at work axis. The proposed new design is presented in Figure 1.

The strategy of an organization is a succession of hypotheses causes and effect between the actions needed and desired results. Thus, the BSC must set out the strategy of the organization through a sequence of cause and effect on the four perspectives of the tool. "Each identified indicator must be a link in a chain of causes to effects related to the strategic direction of the organization" (Niven, 2006).

Therefore, to position the two axes (health and safety and environment) on the BSC, we will define the causal relationship between these six perspectives using a decision-making tool named DEMATEL method (Decision Making Trial and Evaluation Laboratory) which will be applied between the criteria or objectives for each perspective.

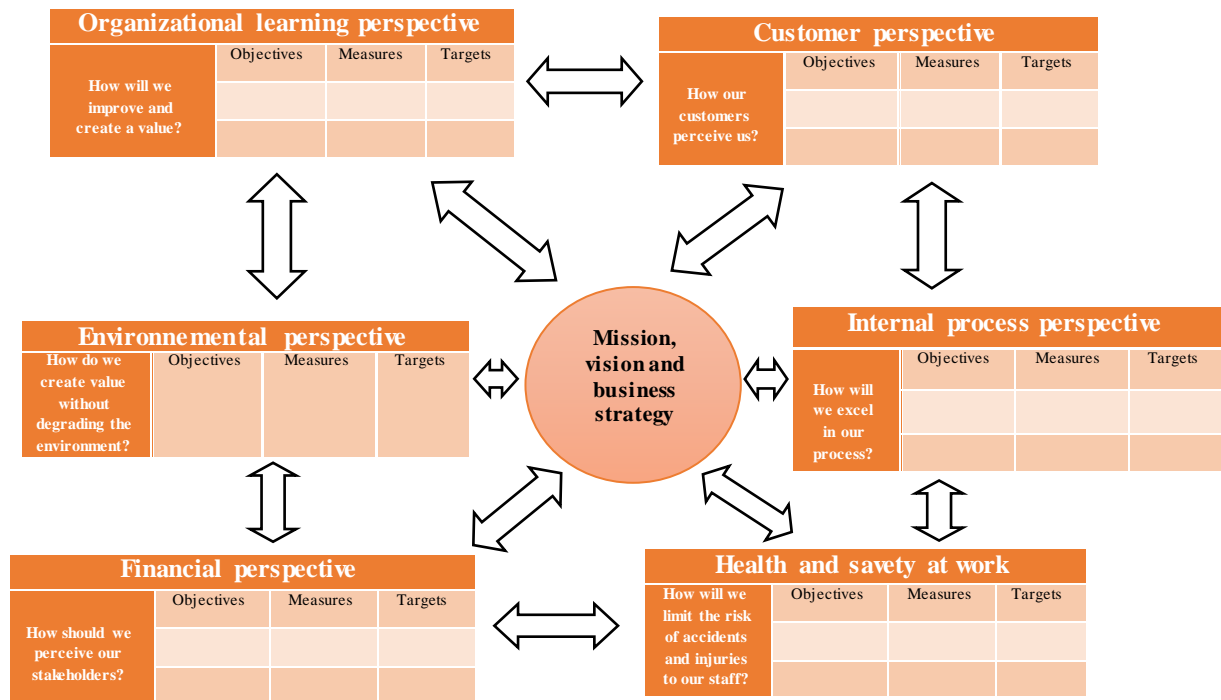


Figure 1. New Balanced Scorecard with six perspectives

5. The DEMATEL method

5.1 Overview

DEMATEL (Decision Making Trial and Evaluation Laboratory) method was originally developed between 1972 and 1979 by the Science and Human Affairs Program of the Battelle Memorial Institute of Geneva, with the purpose of studying the complex and intertwined problematic group. It has been widely accepted as one of the best tools to solve the cause and effect relationship among the evaluation criteria (Chiu et al., 2006, Liou et al., 2007, Tzeng et al., 2007, Wu and Lee, 2007, Lin and Tzeng, 2009). This method is applied to analyze and form the relationship of cause and effect among evaluation criteria (Yang et al., 2008) or to derive interrelationship among factors (Lin and Tzeng, 2009).

5.2 The process of the DEMATEL method

Based on (Yu and Tseng, 2006, Liu, et al., 2007, Tzeng, et al., 2007, Yang et al., 2008, Wu and Lee 2007, Shieh et al., 2010), the process of the DEMATEL method is presented below:

- **Step 1 :** Gather experts' opinion and calculate the average matrix Z

In this step, we will write a questionnaire to evaluate the influence of a criterion perspective on the other (see example in Figure 2).

A group of m experts and n factors are used in this step. Each expert is asked to view the degree of direct influence between two factors based on pair-wise comparison. The degree to which the expert perceived factor i affects on factor j is denoted as x_{ij} . The integer score is ranged from 0 (no influence), 1 (low influence), 2 (medium influence), 3 (high influence), and 4 (very high influence), respectively. For each expert, an $n \times n$ non-negative matrix is constructed as $X_k = [x_{ijk}]$, where k is the expert number of participation in evaluation processes with $1 \leq k \leq m$.

Thus, $X_1, X_2, X_3, \dots, X_m$ are the matrices from m experts.

To aggregate all judgments from m experts, the average matrix $Z = [z_{ij}]$ is shown by Eq. (1):

$$Z_{ij} = 1/m \sum_{k=1}^m x_{ij}^k \quad (1)$$

Criterion A	Influence					Criterion B
Less material waste	0	1	2	3	4	Have the best quality

Figure 2. Example of the evaluation questionnaire.

- **Step 2 :** Calculate the normalized initial direct- relation matrix D

The normalized initial direct-relation matrix is: $D = [d_{ij}]$, where the value of each element in matrix D is ranged in the interval $[0, 1]$. The calculation is shown below.

$$D = \lambda * Z \quad (2)$$

Or

$$[D_{ij}]_{n \times n} = \lambda [z_{ij}]_{n \times n} \quad (3)$$

Where

$$\lambda = \text{Min} \left[\frac{1}{\max \sum_{j=1}^n |z_{ij}|}, \frac{1}{\max \sum_{i=1}^n |z_{ij}|} \right] \quad (4)$$

- **Step 3:** Derive the total relation matrix T

The total-influence matrix T is obtained by utilizing Eq. (5), where I is an $n \times n$ identity matrix. The elements of t_{ij} represents the indirect effects that factor i has on factor j , then the matrix T reflects the total relationship between each pair of system factors.

$$T = D(I - D)^{-1} \quad (5)$$

- **Step 4 :** Calculate the sums of rows and columns of matrix T

In the total-influence matrix T , the sum of rows and the sum of columns are represented by vectors r and c , respectively.

$$r = [ri]_{n \times 1} = (\sum_{j=1}^n t_{ij})_{n \times 1} \quad (6)$$

$$c = [C_j]_{1 \times n}' = (\sum_{j=1}^n t_{ij})_{1 \times n} \quad (7)$$

Where $[C_j]'$ is denoted as transposition matrix.

Let r_i be the sum of the i^{th} row in matrix T . The value of r_i indicates the total given both directly and indirectly effects, that factor i has on the other factors.

Let c_j be the sum j^{th} column in matrix T . The value of c_j shows the total received both directly and indirectly effects, that all other factors have on factor j .

if $j = i$, The value of $(r_i + c_i)$ represents the total effects both given and received by factor i . In contrast, the value of $(r_i - c_i)$ shows the net contribution by factor i to the system.

Moreover, when $(r_i - c_i)$ is positive, factor i is a net cause.

When $(r_i - c_i)$ is negative, factor i is net receiver (Tzeng et al, 2007; Liou et al, 2007; Yang et al, 2008; Lee et al, 2009).

- **Step 5 :** Set a threshold value (α) :

The threshold value (α), was computed by averaging the elements in matrix T , as computed by Eq. (8). This calculation aimed to eliminate some minor effects elements in matrix T . (Yang et al., 2008).

$$\alpha = \frac{\sum_{i=1}^n \sum_{j=1}^n [t_{ij}]}{N} \quad (8)$$

Where N is the total number of elements in the matrix T .

- **Step 6 :** Build a cause and effect relationship diagram

The cause and effect diagram is constructed by mapping all coordinate sets of $(r_i + c_i, r_i - c_i)$ to visualize the complex interrelationship and provide information to judge which are the most important factors and how influence affected factors (Shieh et al., 2010). The factors with t_{ij} greater than α are selected to be shown in cause and effect diagram (Yang et al., 2008).

6. Conclusion

In this paper, we focused on one of the shortcomings of the Balanced Scorecard (BSC) which concerns the absence of axes of health, safety, and the environment. Then, we proposed a strategy for the integration of these axes in the BSC using the method DEMATEL (Decision Making Trial and Evaluation Laboratory) in which we defined the cause and effect relationship between the six axes of the new dashboard prospective. The application of the developed strategy in this paper to a food company will be our future work.

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