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STRATEGIC COSTS MANAGEMENT AT SOCIETIES GROUP LEVEL. MULTICRITERIAL MODEL FOR OPTIMIZATION

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ABSTRACT

In our opinion, the performances at group level must be analyzed differently, depending on the adopted strategy. Thus, we consider that a major problem of the accounting and cost control is their compatibility with the strategy. This is justified by the fact that a certain system, that can be an efficient instrument for assessing the performances of a group whose strategy is cost dominated, could cause malfunctions in a company that adopts a differentiation strategy. Because groups' management currently faces a specific problem – adopting decisions when several objectives are followed simultaneously or the same objective common for more branches – we consider that, in such cases, the decisions cannot be based on a classic model of optimization of a single objective function. We consider that an optimization model with several objective functions, which aims at optimizing the costs for the subsidiaries and choosing a satisfactory solution for the company, is necessary.

KEY WORDS: *costs, the optimization of the costs, decision process, linear programming, games theory*.

JEL CLASSIFICATION: M41, M10

INTRODUCTION

According to the thesis of M. Porter (Porter, 1997), a company can achieve a long lasting competition advantage based on cost or differentiation. The cost domination strategy has as main objective achieving a low cost in comparison with the competition. The differentiation domination strategy consists in differentiating the products by something, which is considered to be unique for the consumers. As differentiation elements, we can consider the brand fidelity, a superior service for the customers, the conception and the specific features of the product, the technology etc. Therefore, gaining a competition advantage on the market, which is one of the problems that the managers must face in the conditions of a bigger and bigger competition, can result either by a superior quality for the customer for the same price, either by the same quality for a smaller price.

By taking over Porter's idea, some authors, among whom M. Gervais (1995), P. Lorino, L. Dubrulle (2002), Ch. Hohmann (2004) sustain that the new approach of management accounting must aim to the integration of the production and to the strategy of the company.

In our opinion, the performances of the activity of a company must be analysed differently, depending on the adopted strategy. Thus, we consider that a major problem of the accounting and cost control is their compatibility with the strategy. This is because, as Shank, J.&Govindarajan, V.(1990) asserted, a certain system, that can be an efficient instrument for assessing the performances of a company which strategy is the cost domination, could create malfunctions in a company that adopts a differentiation strategy. We also find recent preoccupations regarding strategic business accounting at Glynn J.J., Murphy M.P., Perrin J., Abraham A. (2003), which take into consideration the criticisms at the address of management accounting brought about by Robert Kaplan, a well known professor at Harvard University, who considered that theory and research are out of touch with practice, and with what happens in the business world. Like other researchers attracted to the Japanese experience, Kaplan proposes a tighter relationship between theory and practice and offers a synthesis of the practices of management economics in Japanese companies, as well as their perspectives. (We must take into account that this discrepancy between theory and practice is to be found also in the system of management accounting in our country).

Consequently, there appeared the thesis sustained by the advocates of SCM who take into account a closer approach to the strategy. They consider that the role of the accounting system in general, and of the costs, in particular, is that of facilitating the formulation and the translation into practice of the strategy.

In this context appears the strategic accounting (Morse W.J., Davis, J.R., Hartgraves, Al. L. 2000) that sustains the competitive advantage. Thus, one aims to find a market position relatively comparable with that of the competitors.

Strategic Management Accounting-SMA lays the stress on a clear strategy, with a strong quality orientation, associated to the marketing function. This is considered a data basis and a basis of information analysis, which refers to business and to competition, which allows the development of the business strategy (we refer to information about costs, prices, sales volume, cash-flow, results). Thus, the companies' management direction can appreciate the competitive position of their activity and can implement strategies for increasing the competitiveness.

In a reference study regarding Strategic Management Accounting (Innes J. 2004), the emphasis is placed on Strategic Cost Management SCM, respectively on the analysis of the values' chain which supposes the following of the production process from raw material to the finite product offered to the consumers. This imposes a development of the accounting information system with direct impact on the efficiency of cost management.

In this paper, we have analysed the cost domination strategy at the level of a group of societies which comprise in their structure two or more subsidiaries (ESC-complete subordinated entities) on which the group leader exerts the exclusive right control (for he owns at least 50% plus one share of the total number of shares) or the de facto control (situation in which there is no other superior share and thus the group leader maintains his position). Using the mathematical methodology, we have carried out a model for implementing such a strategy, which could improve the information system of the costs in a group. This system must be analysed and assessed depending on its contribution to the success of the group.

Because the management of the societies group currently face a specific problem – adopting decisions when several objectives are followed or the same objective, but for more subsidiaries– we have considered that, in such cases, the decisions can't be made relying on a classic model of optimization of a single objective function. In these circumstances, we have carried out an optimization model with several objective functions, which aims optimizing the costs for the subsidiaries and choosing a satisfactory solution for the group.

1. A MODEL FOR IMPLEMENTING THE COST DOMINATION STRATEGY

1.1. The elaboration of the general model

As previously specified, the model can be applied for the case of a group and aims minimizing the costs for each subsidiary and providing efficient solutions for the management.

The model implies the use of the same technological process for each subsidiary, which remains unchanged, no matter the objective, otherwise speaking, the imposed restrictions are the same, but the costs are different.

In the linear case, we have to minimize the costs for *s* subsidiaries:

$$(1)\ C_k(X) = \sum_{i=1}^{n} C_{ki} x_n \left(k = \overline{1,s}\right),$$

$C_{ki}\left(k = \overline{1,s}, i = \overline{1,n}\right)$ - are the costs made to achieve a product unit P_i to subsidiary F_k.

The restrictions for the functions $C_k(x)$ that have to be minimized (as known from the linear programming models) embrace the following form:

$$(2)\ AX \le B \qquad \text{(or AX=B)}$$
$$(3)\ X \ge 0$$

A – the matrix of the technological coefficients;
B – the matrix of the available resources.
Therefore, we have a solve a problem of linear programming with several objective (efficiency) functions.
In this case, the optimum solution for an efficiency function is not optimum for the others as well. That's why we have to look for a solution that realizes the best compromise, better known as "efficiency solution" or "efficacious solution".
Considering D as the multitude (the domain) of possible solutions for the system (2), $X^0 \in D$ is an efficient solution if there is no $X \in D$ so that $C_k(X) \le C_k(X^0)$, $k = \overline{1,s}$ and for at least a k_0 we have $C_k(X) < C_k(X^0)$.
Otherwise speaking, X^0 is efficient solution if there isn't another solution in D to minimize at least a function when the others remain unchanged.
This concept is used in the game theory as well.
In order to determine such a solution, several methods can be used.
Some of these functions begin with finding the solution x* to minimize a synthesis function of the "s" functions that have to be minimized, meaning the function:

$h(C_1,C_2,C_3 \ldots\ldots C_s)$.

Such a synthesis function can be defined as follows:

a) $h(C_1,C_2,C_3 \ldots\ldots C_s) = \max\limits_{i=\underline{1,s}} \{C_i(X)\}$,

which have to be maximized, which means:

$$\min_{x \in D} \max_{1 \le i \le s} \{C_i(X)\}$$

b) $h(C_1,C_2,C_3 \ldots\ldots C_s) = \sum\limits_{i=1}^{s} \lambda_i [C_i(X)]^{\beta^i}$; $\lambda_i, \beta_i \ge 0$

c) $h(C_1,C_2,C_3 \ldots\ldots C_s) = \prod\limits_{i=1}^{s} C_i(X)$

<u>Notice:</u>
In case a), if $C_i(X)$ are maximum functions, then $h(C_1,C_2,C_3 \ldots\ldots C_s) = \min\limits_{i=\underline{1,s}} \{C_i(X)\}$, which have to be maximized:

$$\max_{x \in D} \min_{1 \le i \le s} \{C_i(X)\},$$

which is similar with the criterion max(min), min(max) from the games theory.
In view of this notice, we shall consider, for the case b), that $\beta_i = 1$, meaning:

$$h(C_1,C_2,C_3 \ldots\ldots C_s) = \sum_{i=1}^{s} \lambda_i C_i(X) \quad , \lambda_i \ge 0,$$

where λ_i represents the weights of the efficiency functions $C_i(X)$, that have to reflect their relative importance in the general process of optimization.
An admissible solution is efficient only if it is an optimum solution for the problem:

$$\min \sum_{i=1}^{s} \lambda_i C_i(X)$$
$$AX=B$$
$$X>0$$

For a certain $\lambda = (\lambda_1, \lambda_2, ..., \lambda_s), \lambda_i > 0, i = \overline{1,s}$ and $\sum_{i=1}^{s} \lambda_i = 1$.
Considering the previous notice and taking into account the conclusions of S.M. Belenson and K.C. Kapur (1983), we shall choose $\lambda_i (i = \overline{1,s})$ as a mixed strategy resulted by solving a matrix game of two persons with null sum.
We'll suppose that the "s" problems of linear programming problems were solved:

$$\begin{cases} \min C_i(X) \\ AX = B \qquad , \ i = \overline{1,s} \\ X \geq 0 \end{cases}$$

and the "s" optimum solutions $X_i^* (i = \overline{1,s})$ were obtained.
We shall construct the matrix:

$M=(C_{ij})$; $i, j = \overline{1,s}$
$C_{ij} = C_i(X_j)$

also named (in the games theory) the payments matrix.
We'll consider a strategic matrix game, with null sum, with maximizing gamer on liner minimizing on columns, with a M matrix.
If $\lambda = (\lambda_1, \lambda_2, ..., \lambda_s)$ and

$\mu = (\mu_1, \mu_2, ..., \mu_s)$

are the optimum mixed strategies obtained by solving the game for the maximizing gamer and respectively minimizing, we shall consider the synthesis function:

$$f_{s+1}(x) = \sum_{k=1}^{s} \mu_k C_k(X)$$

which have to be minimized.
<u>Notice:</u>
The mixed strategy μ of the minimizing gamer was chosen because there were minimum problems. If there were maximum problems, then the mixed strategy λ of the minimizing gamer was chosen.
We'll solve the problem of linear programming:

$$\begin{cases} \min f(x) = \sum_{k=1}^{s} \mu_k C_k(X) \\ AX = B \\ X \geq 0 \end{cases}$$

which for we find the optimum solution X*.
The problem is if X* is an efficient solution.
According to the definition of a mixed strategy:
if $\mu = (\mu_1, \mu_2, ..., \mu_s)$ respects the conditions that X^* is efficient solution, then the problem is solved.

If the matrix game with the matrix M, previously defined, can be gamed by pure strategies (the game has saddle point), id est there is i_0, j_0 so that:

$$\max_i\left(\min_j C_{ij}\right) = \min_j\left(\max_i C_{ij}\right) = C_{i_0 j_0}$$

then

$$\mu_k = \begin{cases} 0 & k \neq j_0 \\ 1 & k = j_0 \end{cases}$$

and $\qquad f(X) = C_{j_0}(X)$

consequently an efficient solution is obtained by solving the problem:

$$\begin{cases} \min C_{j_0}(X) \\ AX = B \\ X \geq 0 \end{cases}$$

meaning x_{j_0}.

1.2. Case study

For a better understanding of the proposed model, we shall present the following case study:
We have to minimize the costs for two subsidiaries, which for:

$$\min C_1(x) = \frac{3}{4}x_1 + \frac{3}{2}x_2 + 3x_3 + 2x_4$$

$$\min C_2(x) = 2x_1 + \frac{1}{2}x_2 + \frac{5}{2}x_3 + \frac{3}{4}x_4$$

$$x_1 + x_2 + 2x_3 + x_4 = 6$$

$$x_1 + 2x_2 + 3x_3 + x_4 = 8 \qquad x_i \geq 0, i = \overline{1,4}$$

Therefore, two problems of linear programming are been solved, by determining the minimum of the functions $C_1(x)$ and $C_2(x)$.
By using the simplex algorithm, we determine the optimum solution for the first problem of linear programming with the objective function $C_1(x)$:

$X^1=(4,2,0,0)$

and for the second problem of linear programming with the objective function $C_2(x)$:

$X^2=(0,2,0,4)$

With the optimum solutions of the two problems of linear programming, we construct the payments matrix:

$M=(C_{ij})$, i, j = 1,2

where $\qquad C_{ij} = C_i(x^j)$, i, j = 1,2

i.e. $\qquad M = \begin{pmatrix} C_1(X^1) & C_1(X^2) \\ C_2(X^1) & C_2(X^2) \end{pmatrix}$

and taking into account the solutions of the two problems is:

$$M = \begin{pmatrix} 6 & 11 \\ 9 & 4 \end{pmatrix}$$

So, we have to solve a matrix game with null sum and maximizing gamer on lines and minimizing on columns, with the matrix M.
If, for the maximizing gamer, the mixed strategy is:

$\lambda = (\lambda_1, \lambda_2)$ with $\lambda_{1,2} \geq 0, \lambda_1 + \lambda_2 = 1$, and for the minimizing one the mixed strategy is:

$$\mu = (\mu_1, \mu_2) \text{ with } \mu_{1,2} \geq 0, \mu_1 + \mu_2 = 1,$$

by solving the game we obtain the mixed strategies:

$$\lambda = \left(\frac{1}{2}, \frac{1}{2}\right)$$

$$\mu = \left(\frac{3}{10}, \frac{7}{10}\right)$$

We can construct a new problem with the efficiency function:

$$C(X) = \mu_1 C_1(X) + \mu_2 C_2(X)$$

i.e.:

$$C(x) = \frac{3}{10} C_1(X) + \frac{7}{10} C_2(X)$$

By making the calculations, we obtain:

$$C(x) = \frac{65}{40} x_1 + \frac{16}{20} x_2 + \frac{44}{20} x_3 + \frac{43}{40} x_4$$

We solve the following problem with the simplex algorithm:

$$\min\ C(x) = \frac{65}{40} x_1 + \frac{16}{20} x_2 + \frac{44}{20} x_3 + \frac{43}{40} x_4$$

$$x_1 + x_2 + 2x_3 + x_4 = 6$$

$$x_1 + 2x_2 + 3x_3 + x_4 = 8, x_i \geq 0, i = \overline{1,4}$$

We obtain the solution:

X =(0,0,2,2)

which is an efficient solution.

CONCLUSION

If we consider the efficiency function $C_1(X)$, i.e. for minimizing the costs for subsidiary F_1, there will be made the products P_1 and P_2, in quantities $x_1 = 4$ and $x_2 = 2$, and will not be made the products P_3 and P_4; thus, we obtain the minim cost for subsidiary F_1:

$\min C_1(X) = 6$.

If we consider the efficiency function $C_2(X)$, i.e. for minimizing the costs for subsidiary F_2, there will be made the products P_2 and P_4 in quantities $x_2 = 2$ and $x_4 = 4$ and will not be made the products P_1 and P_3; thus, we obtain the minim cost for subsidiary F_2:

$\min C_2(X) = 4$.

By admitting the solution of “the best compromise”, meaning an efficient solution for the group, we take into consideration the solution of the problem which for the efficiency function is $C(X)$, which implies that the products P_3 and P_4 will be made, in quantities $x_3 = 2$ and $x_4 = 2$ and will not be made the products P_1 and P_2, and the minimum cost for the entire group is:

$$\min\ C(X) = \frac{87}{20} = 4{,}35.$$

We notice that min $C(X)$ is comprised between $\min C_2(X)$ and $\min C_1(X)$.

Relying on these results, it is interesting to point out the decisions that the group can make, according to the presented case study:

1. Only the products P_1 and P_2 are made in subsidiary F_1. In this situation, the minimum cost is $C_1 = 6$.

2. Only the products P_2 and P_4 are made in subsidiary F_2. In this situation, the minimum cost is $C_2 = 4$.

3. Only the products P_3 and P_4 are made in subsidiaries F_1 and F_2. In this situation, the minimum cost of the group is C = 4,35.

This is too the proposed solution by applying the model. According to the presented case study, let's see which are the quantities of the products P_3 and P_4 that have to be made.

For subsidiary F_1 for the product P_3 we have the quantity $\frac{3}{10} * 2$

For subsidiary F_2 for the product P_3 we have the quantity $\frac{7}{10} * 2$

For subsidiary F_1 for the product P_4 we have the quantity $\frac{3}{10} * 2$

For subsidiary F_2 for the product P_4 we have the quantity $\frac{7}{10} * 2$

If the group will produce in these terms, it will post on the whole the smallest costs and will succeed to face the competition through the cost domination strategy.

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