Models of Marketing Simulation for SMES in Romania: Strategic Game for Marketing Mix Simulation

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MODELS OF MARKETING SIMULATIONS FOR SMES IN ROMANIA: STRATEGIC GAME FOR MARKETING MIX SIMULATION

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ABSTRACT. SMEs in Romania are facing a lack of funds for financing, poor information, inadequate legislative restrictions for developing the economic environment, low level of accessing European funds etc. Funding problem could be partially solved if the marketing department did different marketing simulations before making the marketing budget and the business plan. In this article we review some of the marketing simulation models that can be achieved without the need for investment and as a case study we have chosen to simulate a marketing mix strategy using strategic games.

Keywords: SME marketing simulation game strategy; marketing mix; budget; linear programming

1. Introduction

Nowadays, the new enterprises are recognized as the main source of job creation, innovation and development. In today's business world, new enterprises are recognized as an important source of job creation, innovation and development (Azimzadeh, 2013).

Over the world the company has determined its goal mainly at stability, further at quality, development and profit. Small companies follow more quality and development, but medium sized companies follow mainly development and profit (Holátová, 2013).

In the last three years many SMEs in Romania (about 90,000) have become insolvent. 19,900 of these companies became insolvent in 2009,

21,700 in 2010, 24,078 in 2012 and about 28,000 in 2013 as it is shown by the National Office of the Trade Registry. Only 4-6 % of Romanian firms entered in insolvency avoided bankruptcy compared to 20 % of EU firms.

One of the management tools that could help SMEs to avoid insolvency is a well-founded budget.

2. Literature Review

Unfortunately, in her paper work (Sabou, 2009) dedicated to small and medium-sized enterprises (SMEs) from Maramures County, the author observed that the number of SMEs that have drawn and used the marketing budget is small. Furthermore, only 35% of SMEs have a marketing department, 41% of SMEs have specialized human resources for marketing activity, 44% of SMEs have the budget for entire activity, 44% of SMEs have the budget for the marketing activity. Taking into account the importance of this working tool in managerial activity, namely the budget, the number of those who use an income and marketing budget in their activity should be by far greater. This result can sometimes explain the incertitude that hovers above the SMEs concerning their activities in the future (Sabou, 2009). SME managers should be better informed and should have a thorough study of management and marketing, so one can make an informed decision. Thus, in order to prepare a budget that meets future market requirements, SME managers can make different marketing simulations (strategic games, Monte Carlo simulation, decision trees, what if analysis, joint analysis, Markov chains, Bayesian analysis, distribution models, marketing forecast, etc.)

- Romanian SMEs can use *The Theory of Games which* studies mathematical models in conflictual situations (competitive). Such situations often arise in business practices that can be resolved through *The Theory of Games*, for example, the competitive aspects of the business, advertising and advertising campaigns to promote products and services on the market, etc.
- Monte Carlo simulation can be used to

 estimate the average return and the level of risk of new products - to determine the products that will enter the market;

 forecast the net income, estimate structural costs, acquisition costs, determination of net income sensitivity to various risk factors (such as changes in interest rate and exchange rate fluctuations);

 determine the optimal production materials that should be included in the final product;

 determining how many units of each product range can be ordered from suppliers per time unit

 choosing the best options of two or more possibilities: extending a contract or postpone a project;

- Decision trees represent a simple, but relevant tool for the analysis of multiple variables that apply to very complex decision situations, involving randomly successive events. The chosen option will be the one which corresponds to the largest or smallest expected profit loss possibly with the highest expected value. Using decision trees leads to choosing, for example, the optimal distribution strategy.
- What-if analysis is a quick way to change the values of calculation formula so that multiple solutions should result leading to the optimal choice. It can be used as a tool to estimate the marketing budget or to determine the optimal mix of products.
- Conjoint analysis is used to analyze and forecast consumer behavior in relation to new products to be launched on the market or enhancements to existing products. Conjoint analysis is used to predict possible market share or profit generated by the introduction of a new product in a market where competitors' products are present. Conjoint analysis is used to design an optimal product concept and to identify the market segments that would appreciate it.
- In marketing simulations, Markov chains are often use to forecast market shares of competing products in a given time horizon and to determine the steady state, at which customers do not switch from one brand to another, staying loyal to a single brand.
- Product distribution models contain algorithms that address the special logistics products. These models allow the forecast of products stocks, calculate the minimum cost of transport in rapport with the distances to be travelled, the quantities required, the type of means of transport, the type of product (which requires special transportation conditions: refrigeration, shock protection, theft, etc.).
- Bayesian models fall into the category of multi-criteria decision models that are useful for problems with few options: choosing the product / price strategy in a well predicted market etc.
- Marketing forecast is often used to estimate the trend, the lifecycle, seasonal variation and random variation of some time series formed by sales value, market share, profits, number of employees, expenses, income, etc. for a certain period of time. Marketing projections are often used in the last phases of the development of new products, estimation of market penetration, sales volume and market share.

3. Theoretical Substantiation

The Theory of Games studies mathematical models of conflictual (competitive) situations. A conflictual situation is characterized by the existence of two or more participants (decision makers) and a set of alternatives (courses of action) of which they should be free to choose one or more, with some probability, according to a certain objective - a conflictual situation in which each participant follows a particular purpose being independent in choosing their own actions, but dependent on the results determined by the set of actions, is formalized in game model (Blajina, 2006). The participants use smart strategies to achieve contrary objectives such as: maximizing gain, respectively minimizing loss.

In other words, within the strategy games, all the actions of the participants are taken into account as well as if they comply with the rules so that the values to be distributed among the players in order to gain. Each player chooses their own strategy, their own decision rule, in order to make the best choice among possible variants depending on the probability distribution of the shares.

The Theory of Games postulates the following assumptions:

- Each participant can choose between action strategies;
- Participants know the strategic alternatives of the opponents;
- The outcome of the game will materialize through a loss or gain;

In many cases the choice of the most suitable strategy for a number of possible alternatives can be done by using a matrix formulation of the problem: each row / column will be a strategy (either Ai, i = 1,... m and Bj, j = 1,..., n, these strategies) and decision criterion will be given the right choice of strategy (Suciu).

4. Case Study – The Marketing Mix

On the consumer goods market there are two competitors A and B, which seek to gain a greater number of customers.

- In this respect Company A is considering several strategies for action.

- Increase investment in product quality (Strategy A1);
- Expanding product distribution in depth (strategy A2);
- Price reduction by half in the second product purchased (Strategy A3).

- Company B is to choose one of the strategies of action:

- Expanding public relations - strategy B1;
- Increasing the amount of product, maintaining constant price (strategy B2);
- Product distribution through supermarkets chain (B3 strategy);
- Developing an enhanced product (strategy B4).

Reorient buyers from one company to another as a result of practicing the strategies mentioned is shown in the matrix below. For example, when company A chooses strategy A1, and company B chooses B1 strategy, it is expected that 1% of company A's customers will change their buying decision in favor of the company's products.

Requirements:

The marketing manager wants the evaluation of the results of each strategy and the identification of the equilibrium points of the matrix game.

Solution:

Matrix M probabilities shift customers from one firm to another:

$$\begin{pmatrix} 1 & 2 & -1 & 0 \\ 0 & -1 & -2 & 3 \\ 0 & -2 & 1 & -1 \end{pmatrix}$$

The game has no pure strategy equilibrium points (Blajina, 2006) because the maximum of the lowest values in each row { 0, -2, -1 } is 0 and is different from the minimum of all the maximum values { 1, 2, 1, 3 } in each column which is 1.

$\max (\min.(m_{ij})) = \max \{0, -2, -1\} = 0 = m_{l4}$

$i=l,3 \quad j=1,4$

$\min(\max(m_{ij})) = \min \{1, 2, 1, 3\} = 1 = m_{11} = m_{33}.$

$j=1,4 \quad i=1,3$

The game contains no dominated strategies. A strategy is dominated if each element of a row/column is less than or equal to another element of the same row/column. Dominated strategy is eliminated.

Since not all elements of the matrix M are greater than 0, we add the number k = 4 to each element of the matrix M to obtain the matrix M with all values positives:

5	6	3	4
4	3	2	7
4	2	5	3

We build linear programming problems of maximum and minimum to determine the optimal mixed strategies of the two players. Assuming a rational behavior, the firm will seek to maximize the expected gain regardless of the choice made by competitors. It results the form (1) of economic and mathematical model which formalizes reasoning company A.

Clearly, for company B, which aims to minimize the loss, similar reasoning would lead to linear programming model (2):

$$\begin{cases} \min(x_1+x_2+x_3) \\ 5x_1+4x_2+4x_3>=1 \\ 6x_1+3x_2+2x_3>=1 \\ 3x_1+2x_2+5x_3>=1 \\ 4x_1+7x_2+3x_3>=1 \\ x_1, x_2, x_3>=0 \end{cases} \quad (1) \qquad \begin{cases} \max(y_1+y_2+y_3+y_4) \\ 5y_1+6y_2+3y_3+4y_4<=1 \\ 4y_1+3y_2+2y_3+7y_4<=1 \\ 4y_1+2y_2+5y_3+3y_4<=1 \\ y_1, y_2, y_3, y_4>=0 \end{cases} \quad (2)$$

Optimal mixed strategy of player I (company A) is obtained by writing the coefficients of the objective function coefficients restrictions, limitations and value of the objective function formula in Excel sheet, as shown in Fig. 1:

	A	B	C	D	E	F	G	H	I	J
1	**Problema de mimim**									
2		x1	x2	x3						
3							Restrictii			
4	Coef fct ob.	1	1	1			1,6	>=	1	
5							1,35	>=	1	
6	Coef restrictii	5	4	4			1,35	>=	1	
7		6	3	2			1,35	>=	1	
8		3	2	5						
9		4	7	3			Val fct ob			0,3529
11	Sol optima	0,1529	0,0353	0,1647						
13	**Stragia mixta optima a jucatorului I**									
14		**0,4333**	**0,1000**	**0,4667**						

The formulas used in G columns:

Restrictions		
=SUMPRODUCT(B6:D6;B$11:D$11)	>=	1
=SUMPRODUCT(B7:D7;B$11:D$11)	>=	1
=SUMPRODUCT(B8:D8;B$11:D$11)	>=	1
=SUMPRODUCT(B9:D9;B$11:D$11)	>=	1

For the objective function in cell J11 write the formula:

Objective function value	=MIN(SUMPRODUCT(B11:D11;B4:D4))

For optimal mixed strategy of player I (Company A) in row 14 are written formulas:

=B11/$J$9	**=C11/$J$9**	**=D11/$J$9**

After entering formulas in Excel to choose a linear programming model (Assume Linear Model) with positive (Non-Negative assume) from Menu Data-Solver (Fig. 2).

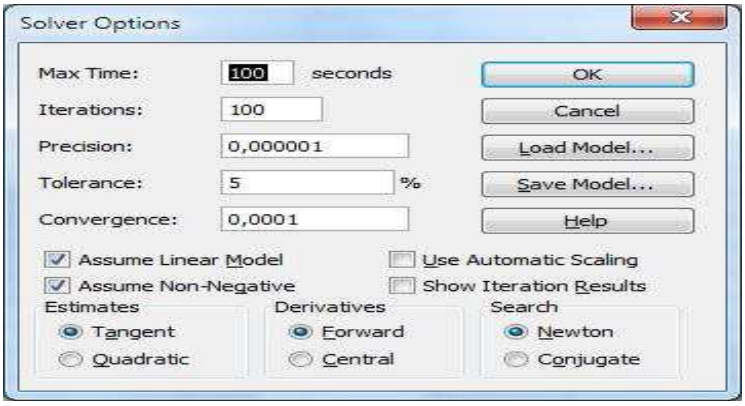

Fig. 2. Setting for a linear model with positive values

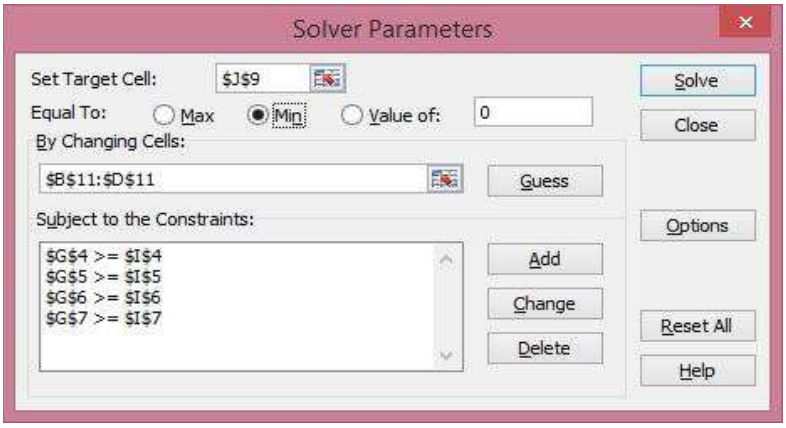

Fig. 3. Setting model parameters (cell displays the function value objectively, the function of min., Cells whose values will be modified and restrictions)

Optimal mixed strategy of Player II is obtained by writing the coefficients of the objective function coefficients restrictions, limitations and value of the objective function formula in Excel sheet, as shown in Fig. 4:

	A	B	C	D	E	F	G	H	I	J
17	**Problema de maxim**									
18		y1	y2	y3	y4					
19							Restrictii			
20	Coef fct ob.	1	1	1	1		1,4	<=	1	
21							1,4	<=	1	
22	Coef resrictii	5	6	3	4		1,4	<=	1	
23		4	3	2	7					
24		4	2	5	3					
25							Val fct ob			0,3529
27	Sol optima	0,0000	0,0588	0,1765	0,1176					
29	**Stragia mixta optima a jucatorului II**									
30		**0,0000**	**0,1667**	**0,5000**	**0,3333**					
31										
32										

Fig. 4 Data to the maximization of profit

The formulas used are:

Restrictions		
=SUMPRODUCT(B22:E22;B$27:E$27)	<=	1
=SUMPRODUCT(B23:E23;B$27:E$27)	<=	1
=SUMPRODUCT(B24:E24;B$27:E$27)	<=	1

Value of objective function**:** =MAX(SUMPRODUCT(B27:E27;B20:E20))

Optimal mixed strategy of Player II

=B27/$J$25	**=C27/$J$25**	**=D27/$J$25**

Therefore, matrix game given by the matrix M admits equilibrium in mixed strategies.

As shown, the outcome is a mixed strategy to obtain a probability associated with the strategies A1, A2, A3 0.43, 0.1, 0.46 and strategies associated with B1, B2, B3, B4 of 0, 0.16, 0.5, 0.33, and the value of game V = 0.3529 (Fig. 1 and 4.)

Company A can count on increased investment in product quality (Strategy A1) and reduction to half price on the second item bought (Strategy A3). Company B can rely on product distribution through supermarket chains (strategy B3) and achieving an enhanced product (strategy B4).

Conclusions:

After applying *The Theory of Games* to calculate the marketing mix,it as obvious that the firm can choose the optimal strategy to minimize loss / maximize profits in conditions of market competition. Knowing the optimal strategy fosters the achievement of a more accurate budget, sustainable. In conclusion, Romanian SME managers must certainly use simulation models in order to be proactive in market terms.

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