Using the Model of Rationalization and Approaching Group Decision within the SMEs in Romania

Cornelia Elena Tureac[1], Ionica Oncioiu[2]

Abstract: Economic-mathematic modeling is used by the manager as an alternative to the experiment used in the exact sciences. The experiment is not possible or it is non-rational when it comes to economic issues, systems that cannot be subject to experiencing. In industry for example, a company cannot afford the implementation of all investment alternatives in order to choose the best one. The model used within the research methodology involves identifying interdependencies between certain elements of the decision-making process within the SMEs in Romania (it may be about set objectives, decision criteria, prioritizing the decision problems). It will be presented the formalization of this decision model for decision problem identification. The group aims at identifying the basic problem, which can cause most of the other problems and determine others. In conclusion after calculating matrices, the resulting situation is not simple, but the first issue that must be addressed is P_4: poorly qualified staff. The next issue to address is P_3: used production equipment. Once P_3 and P_4 are solved, it conditions P_5: poorer quality products, we can therefore address P_5 and P_2: decreased market share; as a result of solving these problems it will be also solved P_1: decrease of turnover.

Keywords: matrix; phase; problem; decision; interdependence

JEL Classification: E17; E20

Introduction

Optimization in the sphere of perfect rationalization is the choice and application of the solutions that provides the most economic efficiency, which best suits the pursued economic interests. The content of the optimal category fully emerged with the mathematization of economics, when they paved the theoretical and practical aspects of the quantification of economic phenomena, and it became possible the calculation technique in optimizing economic processes.

Under these conditions modeling mathematics represents the main tool for researching the economic optimum. In terms of economic-mathematical modeling it represents the extreme value (minimum or maximum) of a mathematical

[1] Associate Professor, PhD, Danubius University of Galati, Faculty of Economic Sciences, Romania, Address: 3 Galati Blvd, 800654 Galati, Romania, Tel: +40372 361 102, fax: +40372 361 290, Corresponding author: tureaccornelia@univ-danubius.ro.
[2] Professor, PhD, Titu Maiorescu University, Romania, 22 Dâmbovnicului Str., Bucharest 040441, Romania, Tel.: +4021 316 1646, E-mail: nelly_oncioiu@yahoo.com.

function, of one or more variables, defined in an area of economic activity, in terms of some constraints as algebraic equations or inequations on the values of these variables.

Economic-mathematical modeling is used by the Manager as an alternative to the experiment used in exact sciences. The experiment, in the strict sense of the word (i.e. the physical change of variables) is not possible or it is when it comes to economic issues, systems that are not subject to experiencing. In industry for example, a company cannot afford the implementation of all investment alternatives in order to choose the best one.

Modeling for the general structure of a decision-making process involves specifying its elements, namely:

- decider;
- problem formulation;
- set of possible variants / alternatives that characterizes a decision-making situation;
- the multitude of anticipated consequences of each variant;
- the multitude of decision criteria;
- objectives proposed by the decider (minimize / maximize technical-economic indicators);
- moods of nature - factors independent of the deciders, the combination of circumstances type.

The specialized literature on this line speaks of a specific category of models, i.e. decision methods and techniques. Most often they are related to choosing the best variant (of deciding), but we should not overlook the fact that, depending on the nature of the decision problem, the other preparatory stages have features of instrumental decision to which it resorts to.

In this paper we use a rationalizing model of group decision, and the best known requirements of rationality of decisions in the group are:

- the used group decision method must be applicable to the set of all possible alternatives;
- if there is a particular decision variant it rises on the steps of decisional preferences of each individual, then it has to climb on the steps of group preferences, as well;
- if the decision relates to "n" possible alternatives, the alternatives' ranking of the group does not need to be modified by considering a new alternative;
- the rule by which the decision should be made by the group should not be independent by individual opinions, but it must depend directly on these views;

- group decision does not need to be identical to the opinion of a certain member of the group without regarding the opinions of others.

2. Research Methodology

The model used within the research methodology involves identifying the interdependencies between certain elements of the decision-making process within the SMEs in Romania (it may be about objectives, decision criteria, prioritizing decision problems). It will be presented the formalization of this decision model for decision problem identification. This implies that after a brainstorming, the group obtained a list of possible decision problems. They are more or less connected. The group aims at identifying the basic problem that causes most of the other, and that it is determined by the least one of the others.

In the first stage it is required to each of the decision-maker to compile a matrix X. The matrix's elements are integers in the range [0,3]. If $x_{ij}=0$, then in the view of the decision maker's problem it does not exert a direct influence on problem j. Conversely if $x_{ij}=3$, the decision maker believes that the problem i determines directly and very strongly the problem K.

The direct links between the problems can be more clearly revealed by representing a Boolean matrix A where the element a_{ij} is 1, if $x_{ij} > 1$ and a_{ij} is 0, if $x_{ij}=0$. The indirect connections to the second rank, weaker, it can be clearly revealed by A^2. The indirect connections of second rank, already much more veiled, are revealed by A^3.

In order to analyze these connections, we will move to phase II. At this stage it is achieved a directional chart. It will represent a directed edge from i to j, if $x_{ij}>0$.

In the phase III, the B matrix is calculated. b_{ij} will be 1 if there is a directional chain from i to j, and 0 otherwise. The argument is valid for all i and j, inclusive for i=j.

In the framework of the fourth stage, the matrix C is constructed using the matrix B as follows: $c_{ij}=0$ if there is no connection between i and j ($b_{ij}=b_{ij}=0$); $c_{ij}=n_d$, if the problem i does not influence, directly or indirectly, problem j, but the problem j affects the problem i ($b_{ij}=0$, $b_{ij}=1$); $c_{ij}=1$, if the problem i influences problem j, but the problem i does not affect the problem j ($b_{ij}=1$ $b_{ij}=0$); $c_{ij}=2$, if they influence each other ($b_{ij}=1$ $b_{ij}=1$).

5th Stage will be reduced to achieving a directed chart based on the matrix X and the matrix C. Thus it will be drawn a directed edge from i to j, if $c_{ij}\geq 1$ and $x_{ij}>1$

Based on this chart, it will deter the problem that needs to be addressed with priority.

In the case of a group decision it is constructed a matrix X for each decision maker. There are collected the resulted matrices X and obtain a matrix X*. It diminishes each element of the matrix X* with 2xn (where n is the number of decision makers), and continuing with phase II.

3. Results

In this paper we present the application of model ranking described in research-methodology at a SME. The company had in the last two years a very difficult period. The main problems identified by the Manager, Financial Director and Production Director are: P_1: the decrease of turnover; P_2: the decrease on the share market; P_3: used production equipment; P_4: low-skilled workers (due to fluctuations of personnel); P_5: poorer quality of products.

Once established these problems the three directors were asked to describe the interrelationships between them. They formed three matrices corresponding to the three directors. The elements of these matrices will be 0,1,2,3 (0 - if problems do not affect each other, 1 if the problem placed on the line influences easily the problem placed on the column, 2 if the influence is strong, 3 if the influence is very strong).

The three matrices are presented below:

General Manager

	D_1	D_2	D_3	D_4	D_5
D_1	-	0	2	1	1
D_2	3	-	0	0	0
D_3	2	2	-	0	3
D_4	1	1	0	-	2
D_5	2	2	0	0	-

Financial Director

	D_1	D_2	D_3	D_4	D_5
D_1	-	0	3	3	1
D_2	1	-	0	0	0
D_3	3	2	-	1	3
D_4	3	3	0	-	3
D_5	3	3	0	0	-

Production Director

	D_1	D_2	D_3	D_4	D_5
D_1	-	1	2	2	1
D_2	3	-	0	0	0
D_3	0	0	-	0	3
D_4	1	1	0	-	3
D_5	1	3	0	0	-

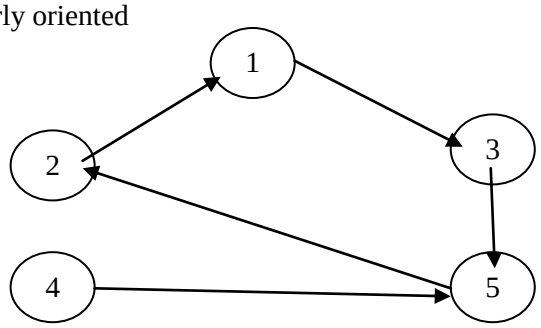
The summed matrix will be:

	D_1	D_2	D_3	D_4	D_5
D_1	-	1	7	6	3
D_2	7	-	0	0	0
D_3	5	4	-	1	9
D_4	5	5	0	-	8
D_5	6	8	0	0	-

For simplification we will make a reduction of each element of the last matrix 2x3=6 (if you get a negative element value, it will be passed as 0):

	D_1	D_2	D_3	D_4	D_5
D_1	-	0	1	0	0
D_2	1	-	0	0	0
D_3	0	0	-	0	3
D_4	0	0	0	-	2
D_5	0	2	0	0	-

It will be performed a chart properly oriented



Graph 1. Graph properly oriented

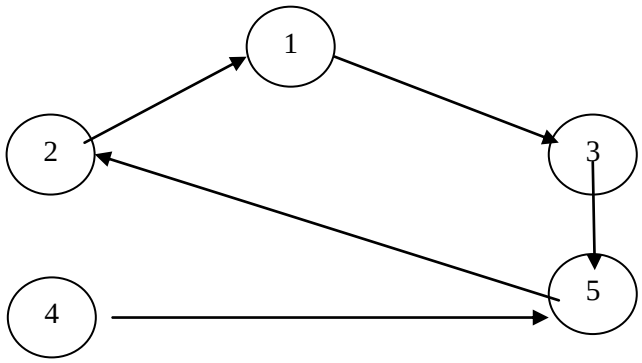
It builds the matrix B

	D_1	D_2	D_3	D_4	D_5
D_1	1	1	1	0	1
D_2	1	1	1	0	1
D_3	1	1	1	0	1
D_4	1	1	1	0	1
D_5	1	1	1	0	1

Based on this matrix, we will obtain matrix C

	D_1	D_2	D_3	D_4	D_5
D_1	2	2	2	nd	2
D_2	2	2	2	nd	2
D_3	2	2	2	nd	2
D_4	1	1	1	0	1
D_5	2	2	2	nd	2

It will be performed a final oriented chart



Graph 2. Final oriented graph

The resulting situation is not simple. Surely the first problem addressed must be P_4: unqualified personnel. Once removed this problem, the four remain in a vicious circle. Our suggestion is that it should be further approached P_3: used production equipment.

This problem would be solved by the acquisition of modern equipment, which should be from external sources (leasing, bank credit) in order to overcome the conditioning, which can be seen from graph 2, is determined by P_1: decrease of turnover. Once P_3 and P_4 are solved, conditioning P_5: poorer quality products, we can therefore address P_5, and P_2: decreased market share, and as a result of solving these problems it will be also solved P_1: decrease of turnover.

4. Conclusions

Optimizing in the sphere of perfect rationalization represents the choice and application of the solutions that provide the greatest economic efficiency, that best suits the pursued economic interests. The content of optimal category has fully emerged with the mathematization of economics, when they paved the theoretical and practical aspects of the quantification of economic phenomena, and it became possible the use of calculating technique in order to optimize economic processes.

Under these conditions modeling mathematics represents the main tool for researching the economic optimum. In terms of economic-mathematical modeling it represents the extreme value (minimum or maximum) of a mathematical function, of one or more variables, defined in an area of economic activity, in terms of some constraints as algebraic equations or inequations on the values of these variables.

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