SIMULATION OF COMPANIES OPERATIONAL ACTIVITIES USING COMPUTERS

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Abstract: In this paper, we emphasize the simulation of a decision making process applied to an international transport company from Romania. Our goal was to establish the most efficient decision, having in view three alternatives: acquisition of one additional truck, acquisition of two additional trucks and the outsourcing supplementary requests of transport services, over the trucks fleet capacity of the company, to other specialized transport companies. In view to determine mathematically the best decision, we applied the decision tree method, in the conditions in which the company's manager offered us a feasibility analysis concerning these alternatives. We also reveal in this paper the opportunity provided by DELMS software functions, which reduce the time involved by solving this decision problem.

Keywords: modeling, simulation, decision, software, optimization, efficiency, resources.

1. Modeling and simulation contribution to complex economic problem-solving on company level

The modern production and the administration of industrial companies bases were established at the end of the 19th century by F. Taylor and H. Fayolle. In their books "Principles of Scientific Management" and "General Industrial Management" a set of principles and methods of organization and management of economic entities were formulated having significant economic consequences. They tackled for the first time the issue of rational approaching of a company running mechanism by employing concepts and instruments like: income, expenditure and investment, all in an analytical manner.

Fayolle and Taylor founded the so-called "classical school" of the early scientific organization of businesses, institution that analyzes and interprets the organization from a technical point of view. Since both initiators of this trend were engineers, they regarded productivity as a mainly engineering phenomenon, establishing that in order to increase productivity the technological and the payroll system should undergo significant changes.

It should be mentioned here that among the concepts used by this "classical school" were neither information nor decision. These concepts were widely used after 1950, to the extent of increasing complexity and size of business.

The company is approached as a complex unitary entity, which triggers the creation of a new school, namely "neoclassical school" which was represented by Peter Druker, Alfred Sloan and Emest Dale.

This school considers that a company's organization and management includes a range of activities such as production, transport, processing and storage of information in the view of decision making both on the micro and macroeconomic level.

The major contribution brought forth by this school is approaching the company from a multidisciplinary, integrative, simultaneously analytic and synthetic perspective, starting from the fundamental goals that are assigned to a company which are essentially economic and also considering the many interdependencies between its components.

Among the research regarding the organizing and management of activity are included the informational aspects of decision-making but also aspects regarding the human relationships that were also analyzed by the "school of behavior" represented by Mayo and Zalesnick who paid particular attention to human behavior during production. They promoted the decentralization of decisions and promoted trust between members of a group which led to the transition from the "economic man" to the "social man", a character who ensures efficiency improvement on human cooperation within organizations, as well as relations improvement with people and external institutions, with which the organization is connected.

From the fifth decade of this century with the emergence of the first electronic computers, the first works of cybernetics and first operational research teams, the information and the decision were promoted among the bedrock elements of the stage.

We are in the stage that besides the traditional processes based on intuition and experience; a number of modern scientific methods of decision making are emerging. These scientific processes are characterized by scientific theoretical foundations, generally based on mathematical methods, while maintaining a general practical and realistic orientation.

Adopting decision-making which are higher and more complex elaborated is made possible by resorting to a variety of decisional methods and techniques that facilitate choosing the optimal decision, each of them fitting into a certain decisional model.

Depending on volume, structure and quality of information that are provided, the decisional models are divided into the following categories:

- deterministic - focusing on high-precision complete information;
- nondeterministic;
- probabilistic.

The employment of these decisional methods and techniques brings about the increase of the rigor and effectiveness level of decision-making, differentiated according to the typology of involved decisional situations.

Economic modeling provides rigorousness of activities to the management but also many ways of reconciling the existing resources (material, human and financial) with the objectives set for a certain period of time, thus offering the ability to think and act better and quickly, without distorting the reality.

The constant need to find the best solutions in management, organization and performing economic activities on the company's level required the continuous improvement of decision-making. In this respect, scientists concerns led to the development and improvement of the reality recording ways and methods.

As a general theory of programming and project control, the method contains chapters devoted to the requirements of a project modeling activities, such as the fundamental parameter under consideration (time, cost, resources), the nature of input data (deterministic or stochastic) aspects concerning the structure or size of projects, variants of succession of activities, etc.

This method, with wide applications in industry, construction, transport, emphasizes the decision-making fundament place in the complex decision-making process, being a fundamental tool in the management, organization and conduct of economic activity, thus contributing to the better use of the available resources.

Other types of applications concern the use of linear programming in optimization of freight and passengers, minimizing expected costs in ports, railway stations, airports, etc.

Among the particular problems of linear programming we can mention the transportation problem (from suppliers to consumers) and a variant which is very frequently encountered in practical applications refers to the transport model of intermediate centers.

Certain progress can be seen in the line of improvement and adaptation to the requirements of practice and the extension of multi-criteria programming application.

However there are many cases when the optimization of economic activity, particularly in industry, based on a single optimal criterion proved to be insufficient.

Regarding the production scheduling, maximizing the turnover, net income, added value, the production capacity loading and minimizing the material consumption, the break times etc. can be studied simultaneously.

Focusing exclusively on only one of these criteria, which are usually contradictory, can affect the accomplishment of the others. In order to overcome this situation the multi-criteria application was required. Although it does not lead to an optimal plurivalent, the multi-criteria solution is suboptimal in relation to each individual criterion; the multi-criteria method ensures the best compromise between the criteria that were taken into consideration. If the single optimum is not accomplished it can be offset by harmonizing the criteria on the best compromise level.

Significant information for the base allocation and optimal use of resources are provided by the dual model of the linear programming, according to which "narrow places" (bottle neck) can be determined in a manufacturing flow as well as the efficiency prices (unit prices) of resources, namely their contribution to the accomplishment of the optimized criterion.

Mention should be made about the recently employment, on an increased scale of the dynamic programming, a method which is specific to modeling of economic processes and phenomena which generally display a dynamic evolution. Dynamic programming is currently a reference method for mathematical modeling theory and practice in most areas of activity, including construction and transport.

In developed countries, where mathematical programming is normally applied to modeling

business processes, many models have been developed and programs have been designed for solving "routing" problems.
Decision-making development and implementation in the diverse and complex environment of economic activities required the use of models that were not included in the mathematical theory such as inventory theory, equipment theory, expectancy theory etc. The theory of inventory there are deterministic and stochastic models for one or more products with storage restrictions, shortages, perish, etc. the theory of equipment considers the repairs and planned revisions, accidental or periodic replacements of sensitive components of an installation etc.
The expectancy theory provides a clear-cut distinction between mono and multi-canal service systems, with different statistical distributions of arrival, waiting and serving times. The models applied in these areas are intended to maximize or simulation and they proved their effectiveness in practical applications for which they had been developed.

1.1. Simulating real systems

The current economic decision-making process is marked by a dynamic complexity, which is objectively increasing concerning all economic phenomena and processes. This is the consequence of an especially more powerful combination energy, financial and information flows encountered nationally, regionally and internationally.
Thus, in a world of interdependence, economic operators should assess the risk and take it through the adoption of certain decisions, from a finite set of possible decisions. Markets instability, the limited knowledge of competitors' future actions, political setting up of economic zone, inflation, monetary policy of the state, economic legislation are only a few elements that have a great impact upon business risk.
Besides the ability to foresee the accomplishment of certain results, the manager should have several decision-making alternatives that are scientifically fundamental to choose from, in the view of estimating the risk of the adopted strategy. The estimations depend on information held, on the ability in their analysis, on the manager's decision-making behavior.
The scientific study of a system or phenomenon can be accomplished by real or artificial experiments. In the economic environment, the real experimentation is rather rare because it involves high costs and risks while artificial experimentation, although it sometimes requires high intellectual and financial effort, it allows the avoidance of some real situations with catastrophic implications.
The analysis of the complex economic systems can be accomplished with analytical methods and techniques for solving the actual economic models:

-setting up the manufacturing program;
-optimal sizing of the expecting systems
-identifying an optimal schedule of supply;
-optimum one-dimensional tailoring;
-identifying the best route to a salesman;
-determining the optimal duration of a work completion;
- investments etc.

For such problems, disciplines such as theory of systems, decision theory, operational research, economic cybernetics, employ appropriate mathematical models.
Mathematical models that can be applied in economics involve in most cases the analytical methods for determining the optimal solution from the admissible solutions. However these methods impose certain restrictions on the modeled phenomena, thus allowing to the bets solution that was selected to maintain this character for a shorter period than the one for which the model was initially designed.
In general, any activity involves a longer time of action, usually characterized by a certain degree of uncertainty regarding the size of the aimed objective.
Due to the complexity of real economic systems, of the stochastic dependencies between different variables and considered parameters, not all systems can be adequately represented by a model that can be solved by analytical methods and that can cover all issues for managerial decision-making analysis for real economic horizon. In such cases the simulation technique is often taken into consideration as being the only available alternative.
The term *simulation* derives from the Latin term "simulatio" which means the ability to reproduce, represent or imitate something. In mathematics the term *simulation* was first used by J. von Neumann and S. Ulam, between 1940 and 1944 during the nuclear physics research was conducted in the U.S. The two mathematicians together with N. Metropolis, Fermi and Los Alamos School staff introduced in mathematics about the same time a new intriguing name, namely "Monte Carlo Method", which consists in using artificial statistical selections for determining some possible variants of studied phenomena.
In the view of management science, simulation is a technique of management (control) of experiments with a computer using a management system model on an extended period of time. According to it the

X system simulates the Y system if and only if X and Y are formal systems, Y is taken as a real system, X is considered an approximation of the real system and the rules of validity of X are without errors.

This definition would have the drawback of developing an abstract theory as applied mathematics researchers designed simulation as a technique of establishing a model for a process or a real phenomenon that is studied on computer and the results are used to make decisions scientifically.

The Simulation Model is applied in a broader sense since it presents both the reality (process, phenomenon) and the way of transforming the input data into explorable data in the view of accomplishing an intended goal. By employing Simulation, instead of seeking the best solution through algorithms as in the analytical modeling approaches, we try to obtain descriptive information regarding the analyzed phenomenon by experimentation.

The descriptive results of the simulation refer mostly to the descriptors. The system of descriptors can be used to predict behavior or system performance under various conditions.

Although the results accomplished as a result of simulation are provided as descriptive variants, it is sometimes possible to introduce a rule to search in the simulation model, thus the descriptive results can be assessed in order to identify the optimal solution.

The simulation process requires the input data generation to be inserted into the model which will use so that to achieve outputs that can be used in variables performance measuring or assessing (objective criterion). In order to design an effective simulation model, we should identify in the system that is thoroughly studied its most important variables and performance criteria.

Obtaining information about a system before it can be achieved in practice by using the simulation technique. Simulation is a technique for accomplishing computer-aided testing (individually or as a personal computer or working in a network) that involve the designing of mathematical and logical models which describe the behavior of a real system over a longer period of time.

Through the simulation process input should be generated taking into account the system's internal states, through a series of algorithms. Thus the outputs should be determined and the time evolution of the system's internal states should be described.

Using simulation can not generate accurate solutions but sub-optimal ones, simulation being thus an effective investigation technique for complex economic issues on the company level, impossible to study in the analytical models using economic and mathematical optimization models.

Simulation begins to be used increasingly in practice because the consequences of some real experiences, without a simulation one can bring about important damage to a company.

In any simulation process a number of important elements are involved, namely: the real system, the model, the computer, modeling and simulation relationships:

- the real system is the system perceived by human senses;
- the real model is the real system replaced and which corresponds to the initial real system requirements;
- the abstract model accomplishes the transition from "the real system" to "the real model", it reproduces the real system by decomposing the system into components and linking them;
- the validation of results is made by checking the concordance of the data of the real system with those provided by the model.

1.2. Simulation of decision-making process by applying the computation technique

In this paper, we emphasize the simulation of a decision making process applied to an national manufactured company from Romania.

Our goal was to establish the most efficient decision, having in view two alternatives: sales through intermediaries without the involvement of the consulting firm to identify market situation, the marketing of products on their own efforts, without testing the market, market research and then use one of the 2 forms of sale presented above.

In view to determine mathematically the best decision, we applied the decision tree method, in the conditions in which the company’s manager offered us a feasibility analysis concerning these alternatives.

We also reveal in this paper the opportunity provided by DELMS software functions, which reduce the time involved by solving this decision problem.

Today we are in a period when the mix of traditional, classical decision making tools based on intuition and experience, are emerging and a great number of modern scientific methods have appeared.

These scientific processes are characterized by a solid theoretical background, based mainly on the use of mathematical methods, but maintaining a general guide, practical and realistic.

In these conditions, higher qualitative decision-making are possible by the means of a large range of methods and techniques that facilitate decision

choosing the optimal decision, each of these variants decision fitting to a decision model.
Economic modeling provides to the management activities its multiple ways of reconciling the resources (material, human, financial) in order to achieve the objectives formulated for a certain period of time, giving management the opportunity to think and act better and faster, and without distorting the reality.
The constant need to find the best solutions in management processes, organizations are searching for the continuous improvement of the decisional processes.
In this context, the actual business environment leads the scientists to develop and improve ways and methods of observation and analysis of the real business processes.
As a general theory of programming and control of projects, requirements modeling method contains chapters devoted to the activities of a project, like: basic parameters under analysis (time, cost, and resources), the nature of the input data (deterministic or stochastic); aspects of structure or size of projects, ranging series of activities, etc. This method, with wide applications in industry, construction, transport, focuses on the design of decision points throughout the complex decision-making process, as a basic tool in management, organization and economic activity, helping to optimize resource availability.
The business simulations can simultaneously track several criteria such as maximizing turnover, net income, value added, the loading capacity of production and minimize material consumption, the break times etc.
Only if they have to achieve only one of these criteria may affect the optimization of one of the others. The correction of this situation requires the use of Multi-analysis.
Multi-analysis doesn't lead to optimal solution, as it is considered to be sub-optimal against each criterion taken separately.
The multi-analysis ensures the best compromise in the optimization for the criteria considered. Failure is compensated by the singular optimum harmonization criteria at the best compromise.
In the developed countries, mathematical programming is applied frequently in the shaping of the economic processes. Consequently, many models have been developed and there were designed various software for solving problems of "routing".
The majority of the Romanian companies have adapted their strategies to the e-business environment requirements and begun in the last period to use the benefits of computer technology.
The education plays an essential role in creating and training the future specialists in view to make efficient decisions at the micro – economic level. Therefore, as university teachers, in order to illustrate how computing can help in making relevant and efficient decisions at the company level, we designed a software that we "called" in a generic way - DELMS (Delphi for modeling and simulation).
In order to understand how the software "DELMS runs, no programming knowledge is required, but only minimal knowledge of personal computer use, knowledge that was gained during the first years of academic formation.
The management decisions making process using the method of the decision tree are made in the decisional complex situations, in which random events that take place successively are involved. By means of this method, the multi-sequential decisional processes are described under the form of some diagrams in which the future events condition the decision, determining a set of values concerning the results of each considered decision alternative [1].
This method offers to the managers an extremely useful tool for making operative decisions, being successfully used in the case of a succession of decisions interconnected in time.
Decision tree method in the data mining approach involves several stages: developing an understanding of the application model, selecting a data set on which discovery is to be performed, choosing the appropriate data mining tasks and deployment of the decision tree in the order to select the optimal decision. [2]
Decision tree models are the transition point from the structuring phase to the evaluation phase of the decision analysis process. The issues generated during the business assessment and the decision hierarchies are important for the foundation of the decision tree model. [3]
Today, the use of computer technology in achieving production but also in decision making at the microeconomic level has become an important factor of competitive advantage for any company.
Enterprises in Romania, dynamically linked to the environment that they operate (and as a consequence of the process of globalization), have begun in recent years to use the widespread benefits of computer technology [4].
Education plays an essential role in creating and training specialists who can be put in the situation of making decisions at micro – economic level. Therefore, as university professors, in order to illustrate how computing can help in making relevant decisions at company level (for a less complex) we have made an application which is

called in a generic way DELMS (Delphi for Modeling and Simulation) [5].
To understand how to use the DELMS application, no programming knowledge is required, only a minimal knowledge of using a personal computer, knowledge that is usually gained during the first years of academic formation [6].

1.3. The necessary hardware features

In order to use DELMS in applications, on the personal computer Windows 95/98/NT Workstation 4.0sp4 should be installed.

1.4. Programming language used

Delphi programming language which is used is produced by Borland American Company. The Delphi program is a visual programming environment, object-oriented, which implies a rapid development and the general purpose applications systems are: Windows 95, Windows NT. By using the Delphi program, effective applications in the Windows operating system can be created. The Delphi language requires a minimum number of code writing.
The Delphi program creates executable files that can be launched even when the running computer system does not have Delphi installed. Delphi is a very large size software program. If desired a full Delphi installation system can be achieved (including utilities such as Borland Database Engine and SQL Links Database Desktop, which is intended for managers, database), then hard disk space will be about 110 megabytes.

1.5. Simulation management with the help of DELMS

The application presents six types of economic simulation issues. From the main window of the application through the "issues" certain components start running that address to the following applications:

- Analysis of the market share evolution of competitive products by using Markov chains;
- Forecast sales of goods on the market (exponential adjustment method of Brown);
- A review orders from different clients (made with spectral vectors);
- Analysis of decision making under uncertainty and risk (using Hurwitz optimistic criteria; the regrets criterion or Savage's criterion; the prudent / pessimistic criterion or Wald's criterion; Laplace criterion);
- Allocation of resources at company level;
- Analysis of decision-making processes in cascade (decision trees).

2. Problem formulation

The "**GALFIRTEXT**" Company from Galati (Romania) produces and markets the product "bedclothes and eiderdown". The company management wants to analyze the need of conducting a market survey by a firm which is specialized in marketing in issues.
The market survey will analyze the opportunity of launching the product on the market if the market is favorable and the product is launched or the market is unfavorable and the new product is abandoned.
The analysis of opportunity should take into account the cost of consultancy provided by the firm specialized in market-surveying services in Bucharest. The cost of study has been approximated at 50,000 USD, which will be paid to the consulting firm when submitting the survey results. The Marketing Company specialists are concentrated on obtaining information that indicates the opportunity of the product launching on the market: the market is favorable and the product is launched or the market is unfavorable bad and the product is abandoned.
The product is expected to have as development potential a weight of about 25% of the national market, although the market is quite competitive, beside the local producers being present and a number of foreign companies with a range of products, that although the quality is questionable, they have successful sales to consumers due to lower prices.
Besides the market research, the producing company is also facing another problem, namely how they choose the best distribution method which is the most cost-effective more and which also has the largest market coverage. The company management has the following variants:
V1- to sell the entire new product quantity by intermediaries (which means a contract for mediation for a secure income of 750,000 mu/ year).
V2 – to sell products by their own efforts (through their own chain of shops and employed traders). In the V2 case the following situations (states of nature) are taken into account:
- SN1 – massive sales of the product on the market, rapid product acceptance;
- SN2 – average sales volumes, moderate product acceptance on the market;
- SN3 – very weak sales under aggressive competition circumstances.
The company management has the following available strategies (S):
- S1: sales through intermediaries without the involvement of the consulting firm to identify market situation;
- S2: the marketing of products on their own efforts, without testing the market;

- S3: market research and then use one of the 2 forms of sale presented above. To be established the sales strategy that brings the highest expected average income to the company from selling the "bedclothes and eiderdown" product.

Certain data regarding the physical production and value can be provided by the statistical statements of the company, on which the expected revenues and the probability of occurrence of the 3 cases can be estimated, as shown in the data presented in Table 1.

Table 1. Probability of occurrence of the three strategic variants

States of nature	Probabilities of occurrence	Estimated income (thousands mu)
SN1	0.5	1000
SN2	0.3	800
SN3	0.2	400

The marketing study has determined the probability of 0.55 that the market is favorable and 0.45 for an unfavorable market. Experts have estimated the probability of simultaneous accomplishment of different states of nature according to the data presented in Table 2 below.

Table 2. Probability of occurrence of the three strategic variants

States of nature	Favorable market	Unfavorable market	Absolute probabilities
SN1	0.38	0.12	0.5
SN2	0.12	0.18	0.3
SN3	0.05	0.15	0.2
Absolute probabilities	0.55	0.45	**1**

3. Problem solution

3.1. Database entry:

- the estimated income of the company and the probabilities of occurrence of the three situations outlined (SN1, SN2, SN3);
- probability of a new product favorable market (55%) and probability of a new product unfavorable market (45%);
- probability of simultaneous accomplishment of different states of nature presented in Table 3.

This table shows that the probability of a favorable market and the company sells large quantities of products is 0.38 and the probability of an unfavorable market and the company sells large quantities of products is 0.12, the probability that the market is favorable and the company sells average quantities of products is 0.12 and the probability that the market is unfavorable and the firm sells the average quantity of products is 0.18, the probability that the market is favorable and the company sells small quantities of products is 0.05 and the probability that the market is unfavorable and the company sells small quantities of products is 0.15.

Probabilities change depending on the results of the market survey, to the extent that more information regarding the market, the potential customers as well as how they react to changes in environmental conditions that will be made available.

Based on data displayed in Table 2 the probabilities of the SN1, SN2 and SN3 statements will be calculated depending on a favorable or unfavorable market as follows:

- the probability of massive sales depending on a favorable market:

P (SN1) = 0.38/0.55 = 0,690;

- the probability of average sales of depending on a favorable market:

P (SN2) = 0.12/0.55 = 0,218;

- the probability of unsatisfactory sales depending on of favorable market:

P (SN3) = 0.05/0.55 = 0.090

The results thus achieved can be summarized in a situation as that presented in Table 3 below.

Table 3. Probabilities depending on a favorable and unfavorable market

Probabilities	Favorable market	Unfavorable market
P(SN1)	0.690	0.266
P(SN2)	0.218	0.4
P(SN3)	0.092	0.334
Absolute probabilities	**1**	**1**

3.2. Classical solving method

3.2.1. Calculus Algorithm:

The expected average income (EAI) of the decision (i) is calculated considering the nature of states j (j=1, 2…n).

$$VMA_i = \sum_{i=1}^{n} p_j * C_{ij}$$

where:

P_j = probabilities associated to the states of nature;

C_{ij} = indicator value for i alternative in j state.

Various possible situations are displayed by the graphic method in a tree diagram, using the following symbols: the event will be represented by branches (sales through intermediaries, own-account sales, and pre-market testing sales);

The nodes or points that appear different decisional alternatives are presented under various forms, as follows:

- If the company management is making the choice, then the node will be represented as a small

circle which empty inside where the name of the node will be inserted;

- if "nature" is responsible for choosing one of the possible alternatives, therefore independent of the firm factors, then the node will be represented by a quarrel empty inside where the name of the node will be inserted.

The analysis of various decisional alternatives on the basis of the probable average income could be accomplished by choosing the strategic alternative that yields the maximum economic benefit.

3.2.2. Solution

1. The activity diagram is built as in Figure 1 below.

a) in node 1 there are 3 possibilities: market launch of the new product after a preliminary market testing, selling the new product on the market by intermediaries and selling the new product on the company's own effort;

b) in node 2 the "nature" is responsible for the choice, the launch enjoying 55% probability of great success and 0.45% probability of failure. Therefore the choice depends on the decision-maker as follows:

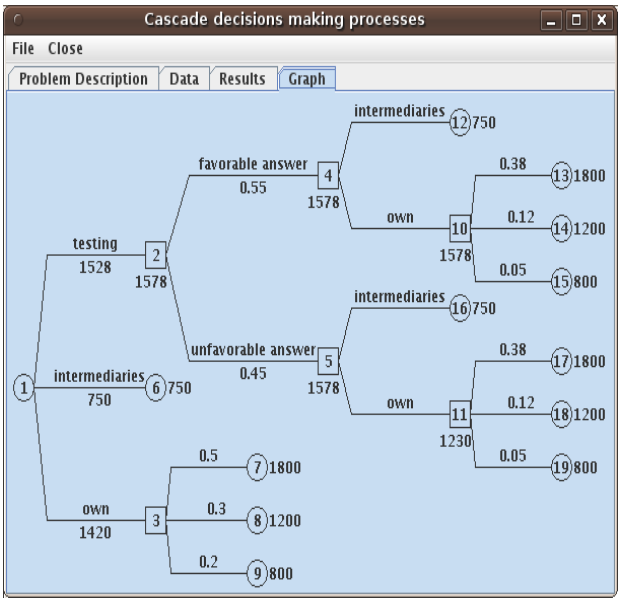

Figure 1. Diagram of activities

- In terms of a nature-friendly state, the decision-maker may decide to sell through intermediaries, in which case the earnings are of 750 thousand mu, which will be also the average revenue value of node 12, or to sell on their own efforts in which case the estimated income that could be achieved will be different depending on the 3 strategies (SN1, SN2, SN3).

- the average income that might be accomplished in node 10, starting from probabilities of occurrence of the three strategies on the favorable market conditions (0.69, 0.22, 0.09) will be:

$$1800*0.69 + 1200*0.22 + 800*0.09 = 1.242 + 264 + 72 = 1.578 \text{ thousand;}$$

- under the circumstances of an unfavorable state of nature, the decision-maker may decide to sell through intermediaries, in which case the earnings will be also of 750 thousand mu and which will be the average revenue value of node 16, or to sell on their own efforts in which case the estimated revenue that could be achieved will be different depending on the probabilities of occurrence of the three strategies in unfavorable environmental conditions. The average income that could be achieved in the node 11 starting from the probabilities of expression of the three strategies in favorable market conditions (0.69, 0.22, 0.09) will be:

$$1800*0.27 + 1200*0.40 + 800*0.33 = 486 + 480 + 264 = 1.230 \text{ thousand;}$$

c) in node 3 the choice belongs to the "decision-maker" who can choose one of the selling strategies on their own, which would yield an expected average income of 1420 mu to the company calculated as follows:

$$1800*0.5 + 1200*0.3 + 800*0.2 = 900 + 360 + 160 = 1.420 \text{ mu thousand;}$$

d) in node 6 the average income that would be accomplished if the sale is made through intermediaries is secured and will be 750 thousand mu;

e) in node 5 - choosing the selling variant will be based on the average income to be accomplished. The selling variant will be chosen to ensure the accomplishment of the maximum expected average revenue:

$$\text{Max } (750; 1.230) = 1.230 \text{ mu thousand,}$$

corresponding to the selling variant on their own. It can be concluded that when the market position is unfavorable, you can choose to sell on their own strategic option, variant which allows the highest average income to be accomplished;

f) in node 4 - choosing the selling variant will be based on the average income to be obtained, will be chosen the selling variant that allows the maximum expected average revenue to be accomplished:

$$\max (750; 1.578) = 1.578$$

corresponding to the strategic selling variant on their own under the circumstances of a favorable market.

g) In node 2 - choosing the selling variant will be based on the average income to be obtained, will be chosen the selling variant that ensures the maximum expected average revenue:

$$\max (1.578; 1.578) = 1.578$$

corresponding to the strategic selling variant on their own regardless of the market position at a certain point: favorable or unfavorable.

3.3. DELMS solving method

The application of the decision tree method in the decisions modeling process in a manufacture company using DELMS software can be solved by following these steps:

a) the main menu is selected from of the six available applications, the application "decision-making processes in cascade" as shown in Figure 2 below:

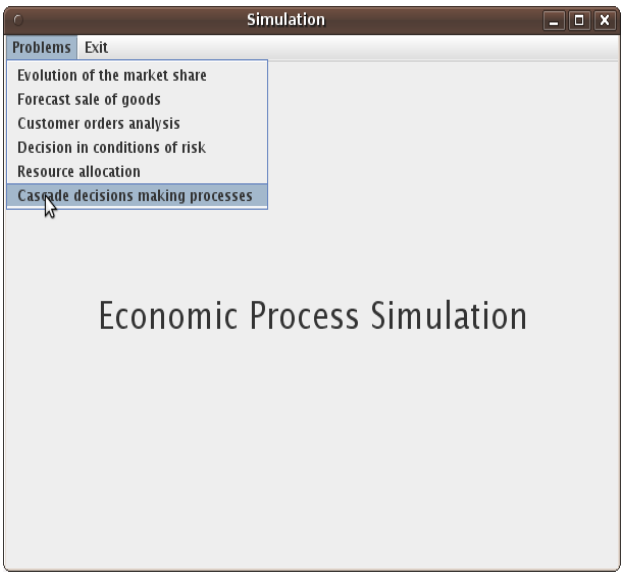

Figure 2. Choosing the problem

After choosing the problem which is aimed to be resolved by pressing the left mouse button, a window will be opened in which we will be presented synthetically details regarding: the informational basis, solving methods and algorithm of calculation, as in Figure 3 presented below.

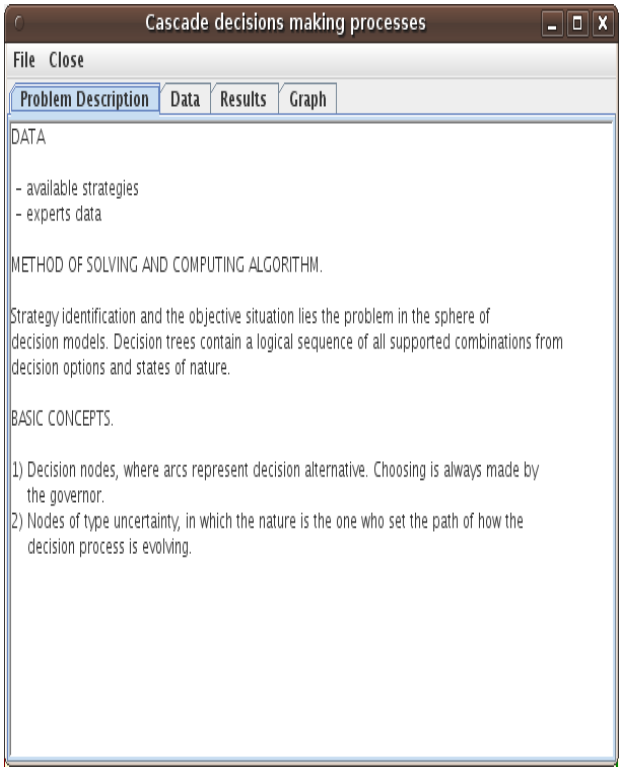

Figure 3. Problem description

b) then we access, by pressing the left mouse button the "informational basis" window, which switches to the loading a new data base as follows:

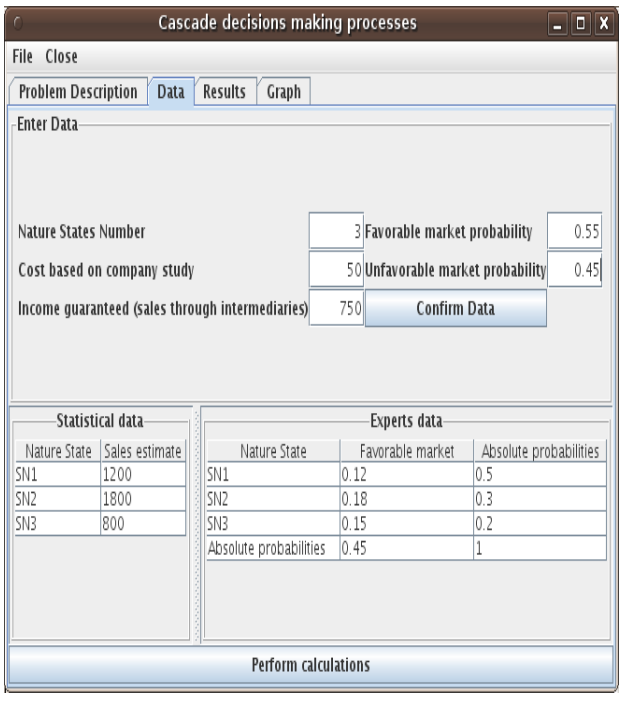

Figure 4. Informational basis

Moving from one box to another within the "**informational basis**" window will be done only by mouse. After entering all required data: number of items, the period for which it is desired to make

forecasts, market shares of the original, the probability matrix of transition from one product to another, the initial data will be confirmed by clicking "**Confirm initial data**" button using the mouse and the application will proceed to the calculation by clicking the "**Perform calculations**" button.

c) After the "**Perform calculations**" command was given, the "Results" window can be opened where we find all input data processed, on the structure of the example above, achieving instead a summary of the type shown in Figure 5 below.

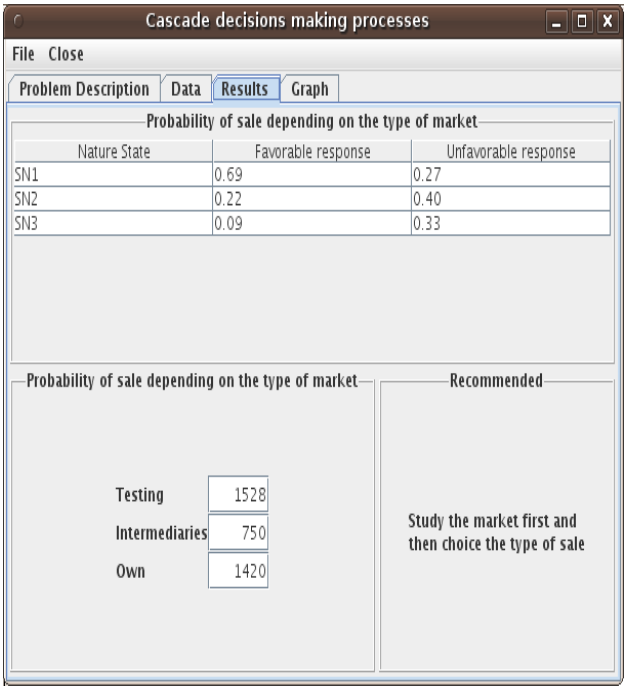

Figure 5. Results achieving

b) Based on data from the matrix above, the "DELMS" program accomplishes significant graphical representations, which illustrate the evolution of the phenomena mentioned above, graphs on which decisions can be taken regarding the policies / trade strategies that may be taken by the company (see Figure 6 below).

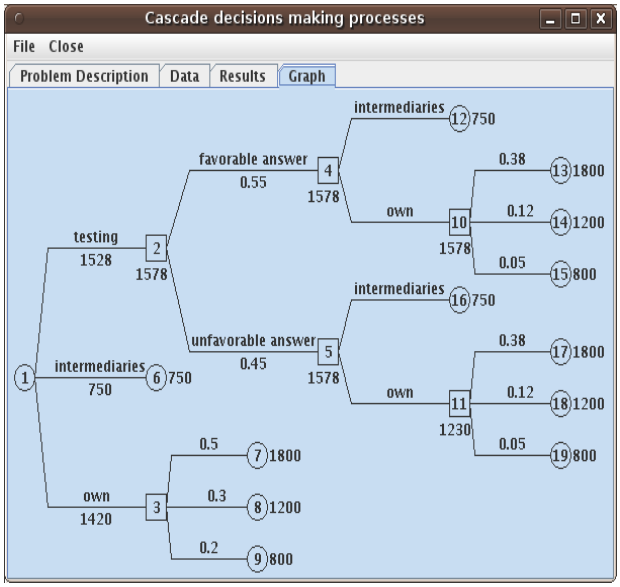

Figure 6. Graphical representation of the problem to be solved

Analyzing the graph above we can say that it shows clearly that the strategic option to be followed by company management in the process of launching the new product on the market, is to choose the strategy that ensures the achievement of maximum expected average income, namely the strategy that launches the product on the market with pre-market testing. Even after the expenses were paid on market research, the remaining income will be higher than all other variants.

4. Conclusions

We have made DELMS to be used exclusively for educational purposes, as support for applied activities that have the following features:

- Modeling is a partial management as simulating a small number of activities in some fictitious companies;
- Participatory management is a simulation, because the participants are organized into teams, the adoption of decisions by the group, one of the main objectives we have pursued is achieving simulation by the involvement of all team members that participate in decision making and also the awareness of the benefits provided by teamwork;
- Is a management simulation involving in particular the average level of management, marketing departments namely: supply, production and finance?;
- Is a computerized management simulation as it facilitates the decision making by the participants and especially processing decisions (simulation proper) that uses an application?

In the globalization of the manufacture market product and in the context of the financial crisis, the competition pushes the companies' managers to

make strategic, tactic and operational decisions which allow the implementation of strategies focused on low costs and implicitly low prices for customers.

The decision tree method represents a simple decision tool, but in the same time complex as it provides the opportunity to design several decision alternatives and to choose the most efficient one. The simulation of the economic consequences of the different decision alternatives, before their effective implementation, offers the surety of the decisions making process quality.

Our model reveals the advantages of the decision making process simulation, facilitated by DELMS software. Once the optimal decision is found, the manufactured company manager can seek to improve that solution by finding ways to relax binding constraints. This model can be personalized to any type of business activity, revealing the interdependences between its variables and constraints and emphasizing the value of the decision tree approach in the formulation of a business problem.

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