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THE CORRELATED APPROACH TO SOME ECONOMIC-MATHEMATICAL MODELS ASSISTED BY THE COMPUTER

We present the "Manager '98" software developed in Visual Basic designed for solving some of the managerial problems, which may appear in an enterprise. It uses economic – mathematical models like Markov chains, Brown, Bellman, matrix calculus, all these in a correlated approach. The article here is illustrated with numerous examples, to better understand the using of the software.

Key words: *managerial decision, enterprise, market, forecast, restrictions, risk, uncertainty, quantitative methods, conversational system.*

To be useful to the practitioner, the economic-mathematical models are characterized by simplicity, flexibility, accessibility and adaptability. These attributes become true only as a consequence of how well and correct the analyst knows the real situation, the process that is modelled, in other words of how he integrates the model into the concepts and thinking of the system analysis.

Among the methodologies already known [1,3,8] we have chosen a constructive approach in which the system of models building the application could help the company in achieving its objectives as set by the managerial team through technical-economic indicators.

The gist of this analysis and also the modules identified in the " Manager'98" application can be seen in figure no.1

All these modules were selected and defined in such a way that they are suited to a quantitative solving, i.e. to an approach using economic-mathematical models.

There are various programs which can solve problems applying linear programming (including those which require integer solutions or more than one objective function), the Critical Path Method or the Monte-Carlo simulation.

Considering this, taking again this type of problems was given up; instead a correlated approach to the other models was conceived. This is the way "Manager'98" was born.

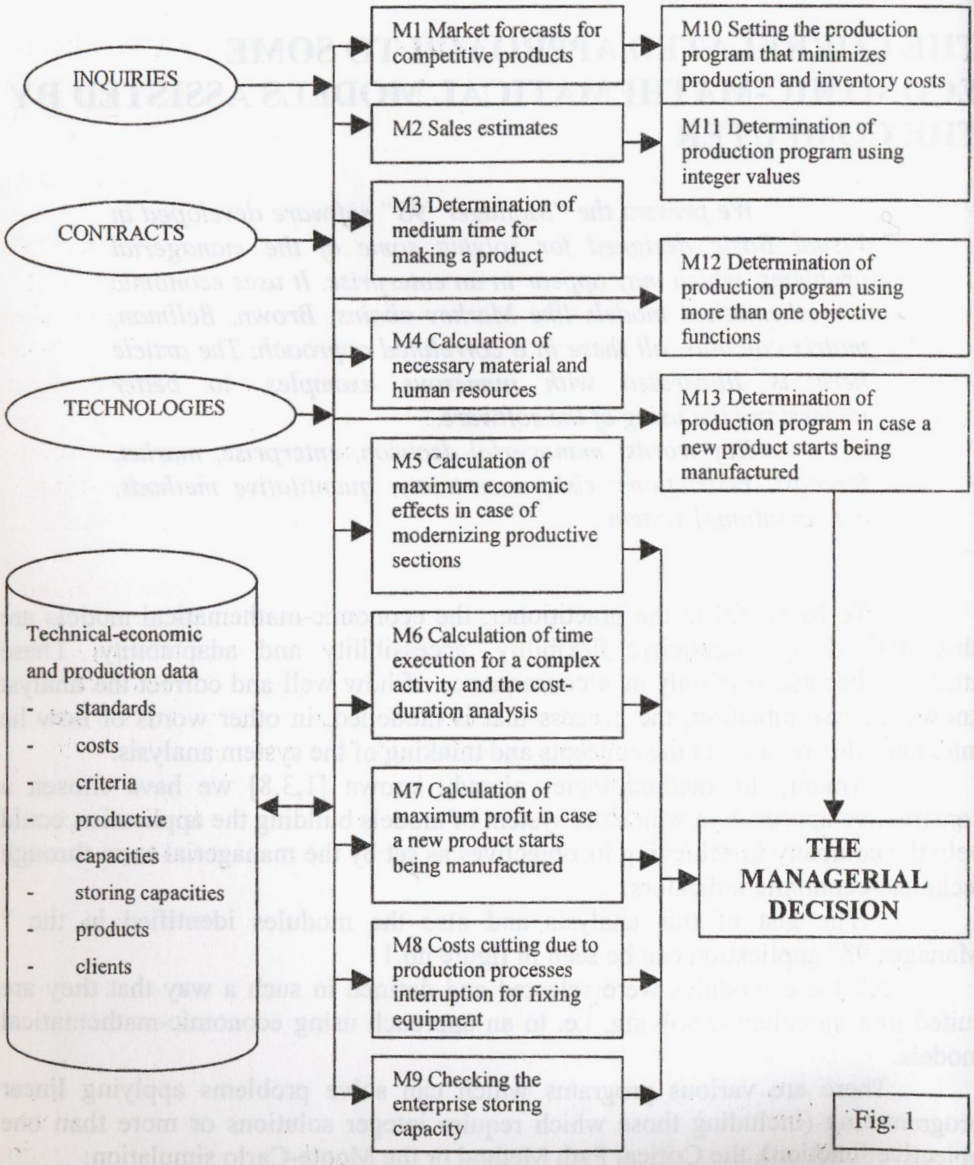

Fig. 1

"Manager'98" is made up of 12 modules, which solve, at an enterprise level, the following problems:

- Forecast of sales using an exponential smoothing Brown model (the program is called NIVEX).
- Studies on the evolution of market shares for competitive products using a Markov chains model (COTEMARK and COTEDIM).
- Supply structure in conformity with the schedule of monthly delivery using the matrix method of spectral vectors (SPECTRU).
- Decision of modernizing productive units depending on economic effects using a dynamic programming model of Bellman type (DINAMIC).
- Calculation of the necessary resources, which can or can not be stored using matrix and the algorithm of summed explosions (EXSUM).
- Results obtained by operating these models may constitute input data for decision under risk models, useful in this case being the decision tree (ARBORE) or decision under uncertainty models where criteria specific to the theory of decision are used (OPTIMIST, WALD, HURWICZ, LAPLACE, SAVAGE).

The 12 modules and also the models implied are presented synoptically in annex no. 1.

We consider necessary to specify that the mathematical aspect of the models, the possible requirements, the type of information needed in the models, facilitation provided and also the consequences resulted form the economic analysis may be found in specialized literature [1, 3, 4, 7, 8].

The manner of correlated approach to a company's problems by making use of economic-mathematical models for decision making and also the friendly

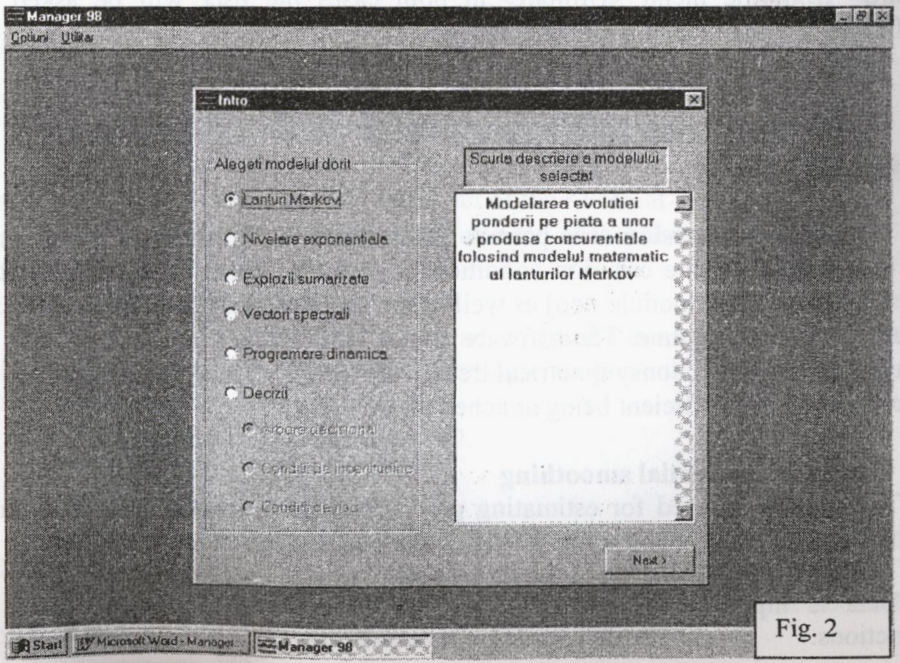

Fig. 2

using of Manager '98 software (dialogue, return possibilities, graphic illustration of results) make it accepted by both students in solving practical problems at a microeconomic level and practitioners.

In the following lines we make a briefing of the user's guide:

1.1 Quick install

- insert first disk from the distribution media in the floppy (3 ½ ") and launch the SETUP.EXE file
- follow the on screen indications for a quick install

1.2 Quick launch

- use the shortcut named " Shortcut to Manager'98 " from the desktop
- use the following path " Start / Programs / Manager'98 "

1.3 First steps

- in the introductory window select a module and at the same time read its short description in the right-hand part of the screen
- double-click the <Next> button for launching the selected module
- modules may be selected as well from the <Optiuni> menu , which is at the top part of the main window (the user has the possibility of launching simultaneously two ore more modules)
- finish the work-session by closing the main window or by choosing command <Iesire> from the menu <Utilitare>;in both cases the user will be asked for confirmation when leaving the application

2. THE DESCRIPTION OF THE MODULES INCLUDED IN MANAGER '98

2.1 The decision tree permits finding out the optimal decisions under risk and more than one criterion condition. It requires probabilities of the nature states (like the RISK module, too) as well as the succession of possible decisions at different moments in time. The software allows input data on a matrix format, for both symmetrical and nonsymmetrical trees. The maximum number of objectives is 5, an importance coefficient being attached to each of them.

2.2 Exponential smoothing

- The module is used for estimating product sales; the exponential smoothing method is applied for a horizontal phenomenon characterized by average value.
- The maximum number of restrictions is 30.
- Data is input following indications on attached labels and fulfilling set restrictions.

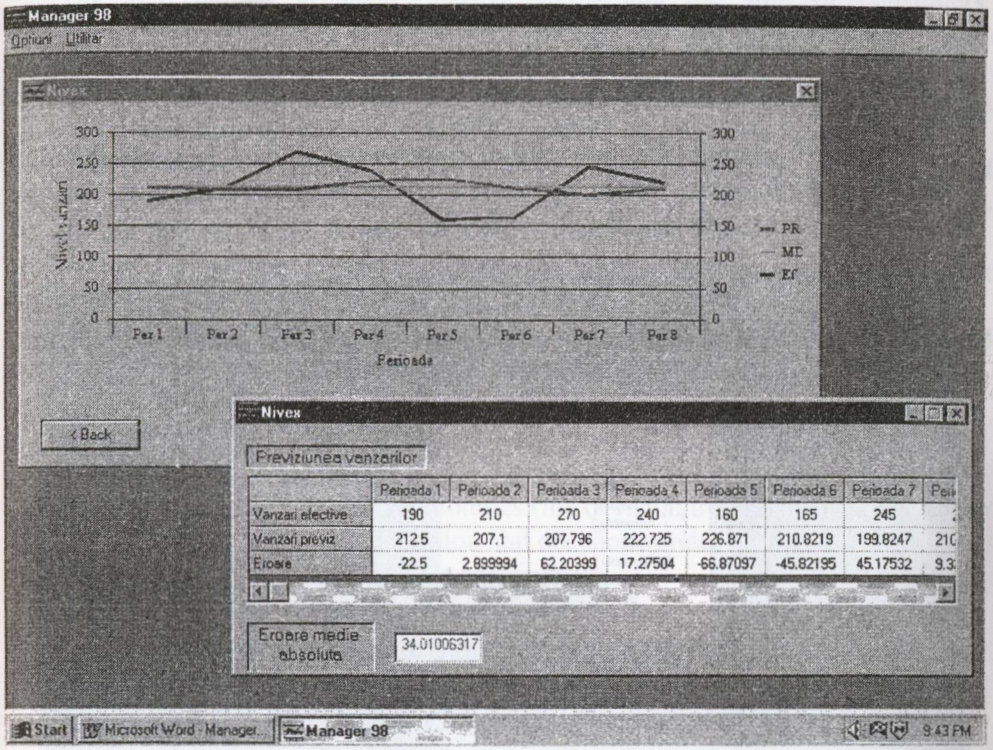

Fig. 3

- After ending data input click the <Calculeaza> button in order to fill in the table of results.
- Output may be seen in graphical format as well: click the <Grafic> button.
- For better visualization of the analyzed evolution the user has the possibility of choosing one of the 10 preset chart types out of the <Format> menu.
- For chart printing select <Print> command out of the <File> menu.

2.3 Summed explosions

- The model is used for calculating the necessary material and human resources on the basis of standards from the technologic records; the summed explosion matrix algorithm is applied.
- Maximum number of components: 100.
- Maximum number of materials: 10.
- Maximum number of workshops: 10.
- The input data is introduced following indications on attached labels and fulfilling set restrictions.
- The product structure is determined using information from the technological records; afterwards fill in the tree format describing the structure.

- Click the <Next> button to fill in the structure table.
- The user has the possibility of calculating necessary materials or human resources by selecting the suitable option.
- When input data is ready, click the <Calculeaza> button for visualizing the table of results.
- Whether for example the necessary of material option has been selected, there is the possibility to obtain results for the other option as well, maintaining the same input data: in order to do this click the <Finish> button.

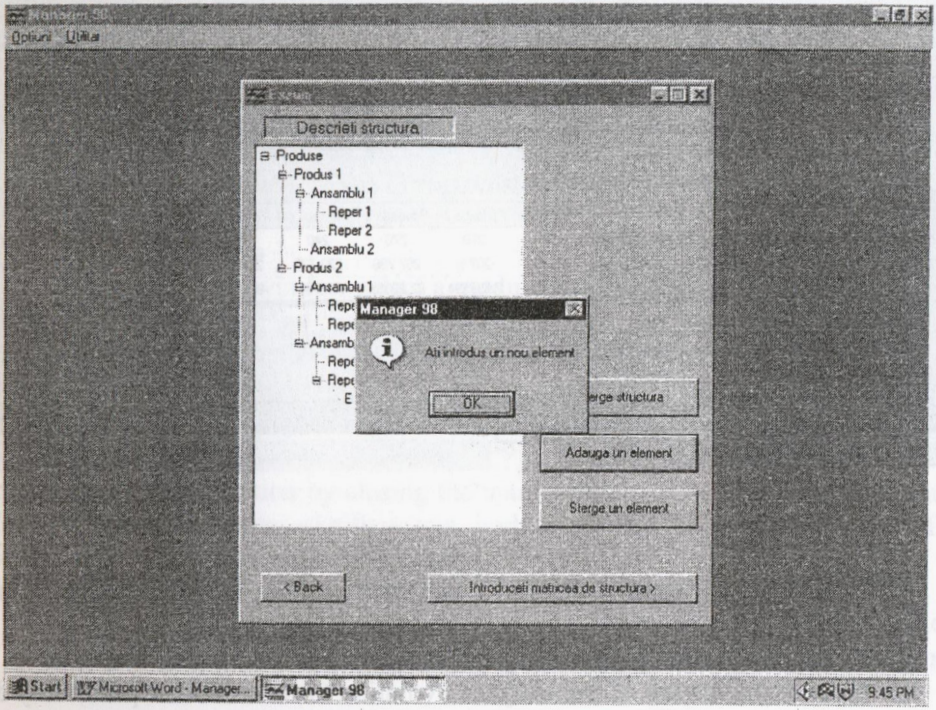

Fig. 4

2.4 Market evolution for competitive products ("lanturi Markov" module)

- The program is used for modelling the market evolution of competitive products depending on the shares they hold at a certain moment and also the future consumers' preferences for these products.
- The maximum number of products: 50.
- The maximum analysis period: 24 months.
- The input data is introduced following indications on attached labels and fulfilling set restrictions.

- The sum of the products' market shares and the sum of consumers' reorientations towards other products must be equal to 1; the software draws user's attention when this condition is not fulfilled.
- The module may be configured to reintroducing transition probabilities after a given period of time if these are changed; in order to do this, tick the checkbox.
- After ending data input click the <Next> button in order to see the table of results.
- In case that data is incorrectly input user is warned of his error.
- Output may be seen in graphical format as well: in order to see the chart click the <Grafic> button.
- For better visualization of the analyzed evolution user has possibility of choosing one of the 10 preset chart types out of the <Format> menu.
- For chart printing select <Print> command out of the <File> menu.

2.5 Decision problems

- This module includes three submodules (the decision tree that has already been described decisions under risk condition and decisions under uncertainty).
- Maximum number of decision alternatives: 12.
- Maximum number of states of nature: 12.

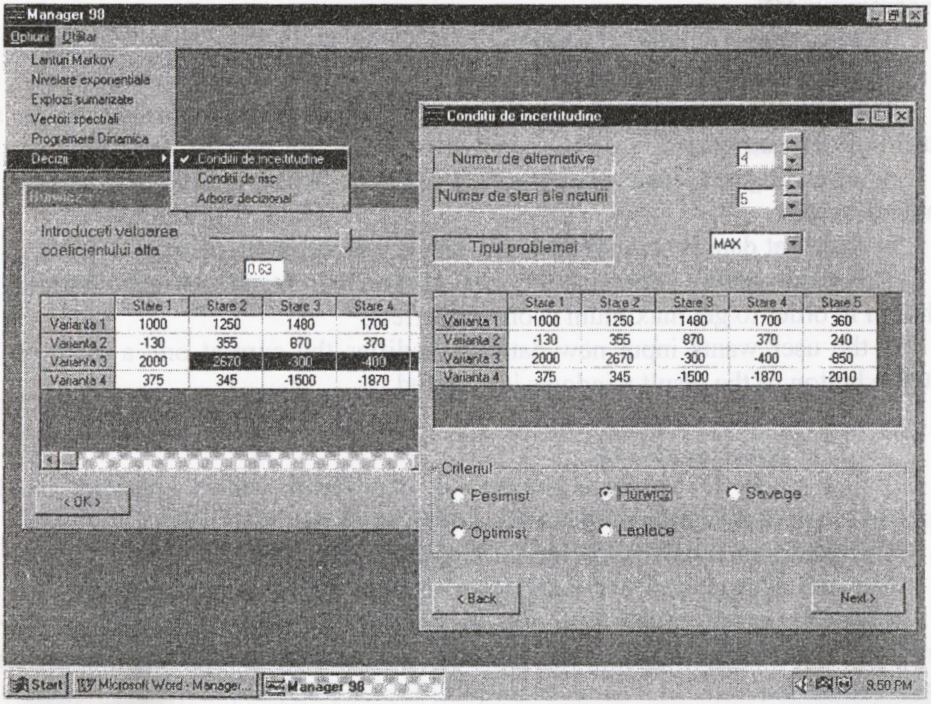

Fig. 5

- In the RISK module the user must introduce probability estimates for the states of nature; sum of these probabilities must be equal to 1.
- In the INCERTITUDINE module select one of the five available criteria (optimist, Wald, Hurwicz, Laplace, Savage).
- The program allows simultaneous result display in case of selecting different criteria for the same input data.
- After ending data input click the <Next> button in order to fill in the table of results.
- In case that data is incorrectly input user is warned of his error.
- If the user wants input new data or modifies the current one a click on the <OK> button of the result windows is required.
- In case a new problem is introduced or input data needs modifying, visualize results only after clicking the <Next>button.
- In Hurwicz window the user may dynamically input value for coefficient alpha (α), so that results evolution may be visualized as function of the input value.

2.6 Dynamic programming

- The module is used for calculating maximum economic effects in case of modernizing productive sections; it applies Bellman sequential dynamic programming.
- The maximum number of objectives: 25.
- The maximum invested sum: 500.
- The input data is introduced following indications on attached labels and fulfilling set restrictions.
- After ending data input click the <Calculeaza> button in order to visualize the table of results.
- In case that data is incorrectly input user is warned of his error.
- The result window contains the total number of optimal variants that may be chosen in order to get maximum economic effect.
- If the user wants input new data or modifies the current one a click on the <OK> button of the result windows is required.

2.7 Spectral vectors

- It is a model for products delivery in conformity with a constant schedule applied to successive orders; the method of spectral vectors is used.
- The maximum available period for analysis: 12 months.
- The sum of input data in the delivery schedule table must be equal to 1.
- Input the current month (the one the analysis is made in) and the number of previous and ulterior months; the program will display the months input data is required for.
- After ending data input click the <Calculeaza> button in order to visualize the table of results.

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