THE IMPORTANCE OF EXPERT SYSTEMS IN ASSISTING LOGISTIC DECISION

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Abstract: *The fast evolution of information technology has prompted significant changes in management organization, especially in the field of specific systems and processes. Consequently, the concept of management information system has emerged to signify the identification of problems and opportunities on an organizational level. An extremely important category of these information systems is represented by the systems that are used to generate decisions with the purpose of offering an interactive informational support for managers during their decision making process.*

Keywords: *military organization; logistics; logistic decision; expert systems.*

Decision making for a logistics manager implies the possession of logistic information/data that is analyzed, evaluated and processed, as well as the tracking of several alternatives to solve a particular problem, of which the optimal one is to be selected.

The use of expert systems in order to adopt logistic decisions entails a faster process and a more efficient decision making.

Systems for decision support generally use analytical methods, specialized data bases or (computer based) interactive models.

These systems are constituted on an ad hoc basis, they are dynamic and they offer managers fast, even instant, solutions.

A decision support system usually has the following components:

-hardware elements;
-software elements;
-human resources;
-specific data;
-a processing model.

As a definition, an expert system is the program which allows to split the declaratory knowledge, this being declared in the terms of propositional calculation, from procedural knowledge which is used in the algorithm of processing those knowledge.

In essence it can be said that this is the main principle of making programs based on propositional calculation forms.

As a rule the elements of an expert system are the following:

• acquiring knowledge – represents the mechanisms of taking the knowledge from a human expert (part named EXPERT) in a strictly defined domain. The scope of acquiring the knowledge is to allow building a knowledge data base, which is a static process, the same with the process of collecting data for a data base (materials stocked in the military units depots, procured materials, etc.);

• representing the knowledge – defined mechanisms and processes of knowledge formalization (in therms of formal logic) in order to implement those as a data structures (knowledge data base) in a physical system of automatically processing data;

• processing the knowledge – is the procedure of using an artificial reasoning to a data base, the scope is to adjust the logistic system inside military organisation;

• utilising the knowledge – has the role of responding to operator requests, which are requests of utilising the logistic information (quantity and types of food used for a military exercise, type and quantity of goods which has to be sold)inside military organisation.

As a particular case we will present an expert system which can be utilised in the process of assisting the logistic decision, this being know as *EXSYS*.

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This is a product of an American company and it was launched in 1989, the newest version is *EXSYS Professional* and it is working in graphical modes controlled with WINDOWS 95, NT, Presentation Manager şi X-Windows.

EXSYS-ul has two main elements:

- the generator or the editor of production rules to create / modify a data base;
- RUNTIME component or "for consulting" which allows to use the newest data base created;

EXSYS can be defined as a convivial generator, elaborated for IBM's PC/PS which operates with rules of IF-THEN-ELSE type.

The rules editor works with rules already edited which can be modified or erase, in all cases, EXSYS is capable to verify and validate the rules during the time when are introduced in data base.

Tied with the process of acquiring knowledge, the fast prototype of this generator can be used if you follow these steps:

buying the EXSYS Professional software;

establishing / identifying the logistic domain and its expert;

editing the production rules, on paper, using the human expertise;

editing the rules with EDITXS component;

- realizing the demonstrative prototype for expert system which executes the most important function of logistic problem or which offers a good entry solution;
- creation, testing and evaluation of data base;
- obtaining of expert feed- back in logistic domain and implementing his expertise to improve the rules;
- editing the data base to include all expert improvements and expertise until expert system will execute everything is wished;
- elaborating the instructions for the new created system;
- nstalling the system to operator and training the personnel, followed by necessary maintenance.

The rule of production in EXSYS Professional has 6 components, as it follows:

- IF <premises>;
- THEN <conclusion-1>;
- ELSE < conclusion -2>;
- NOTE <comment>;
- REFERENCE <comment>;
- NAME <name>.

The last four components are optional.

The IF part is created through a combination of values and qualifiers, part of THEN is created through a combination of options and probabilities, which are considered certainties.

EXSYS offers 6 methods for certitude factors : Yes/No, [0,10], [-100, +100], Incr / Decr, Costum Formula şi Fuzzy.

The left limits of each interval represents absolutes incertitude, those from the right mean absolute certitude and intermediary values indicates certainties factors which recommends action, those three natural statuses being a characteristic of logistic decision.

Inside a rule, if all the conditions are true, then the conclusion is true, fact which determines to take the rule in the attention of interference engine for execution.

The sentences from IF part, as other also are sentences in English, Romanian or even mathematical expressions. The THEN and ELSE parts contain possible solutions, from which EXSYS can select.

The solutions are represented through a sentence follow by the probability written with *Confidence*=<n> syntax, where <n> is a value from a scale, as an example: 8/10, 5/10 etc., if use scale from 0 to 10.

In the moment when expert system finds the solution to the logistic problem, it displays a list (in decreasing order of attached probability) of possible solutions.

For developing and utilising an expert system (in suplly, maintenance or services) the specialist has to know standard operating procedures, as it follows:

- the procedure of creation data base (introducing the qualifier, the values, creation of IF THEN and ELSE parts, creation of NOTE part – optional, REFERENCE and NAME parts, visualisation of created rule);
- the procedure of adding variables (introduction of variable name, introduction of a text for variable function), the way which will be displayed the variable at the ending session of consulting);
- he procedure of editing / modifying a rule;
- he procedure of moving a rule, which is realised through the same operations: selection at beginning, selection at ending and introduction of rule number in front of those which it will be moved;

• procedure of erasing a rule which is realised through operations : introducing the number rule after operation Delete Rule, then YES to confirm the erase;

• the procedure of printing for an expert system;

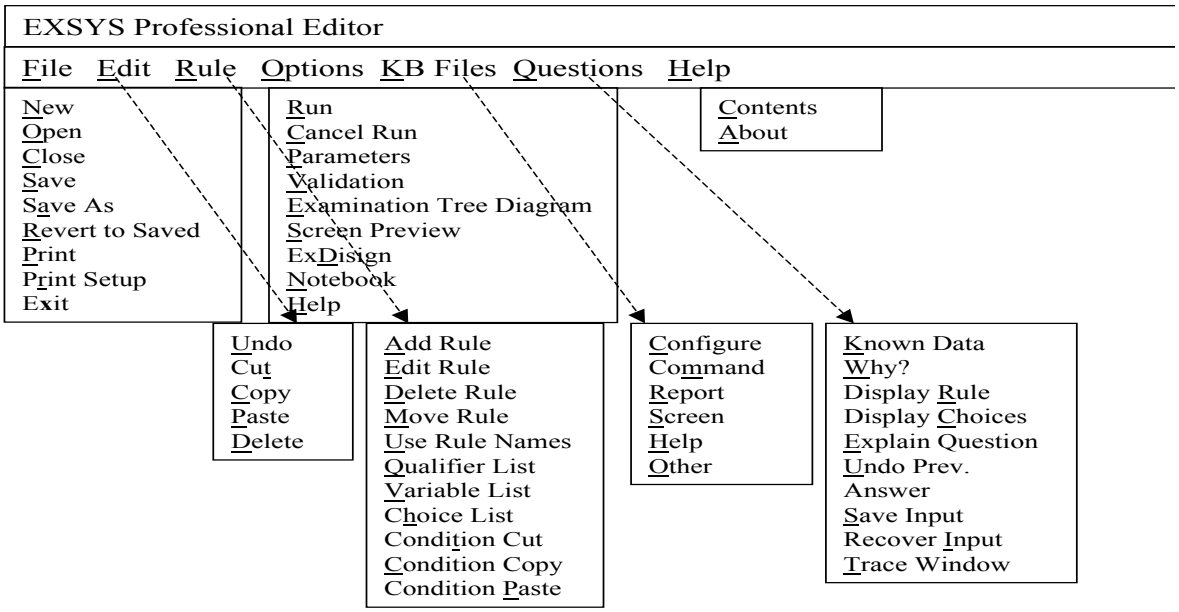
• the procedure of execution (consulting) for the new created expert system with operations : launching in execution of EXSYS Professional generator, calling option File/Open, selecting the execution data base, selection of option Options/ Run;

• the procedure of saving and escaping from expert system generator;

• the procedure of finding a data base is the same with the command used at creation with the difference that instead of File/New, File/Open will be used.

The menu and under menu structure after opening an EXSYS data base is represented in the next figure:

The knowledge of the important concepts is recommended in order to develop an expert system through the EXSYS Professional generator.



Expert systems generated with the EXSYS Professional contain individual facts embedded into knowledge constructs for decision making representing knowledge by the method of *rules of production*. These rules are shaped as IF-THEN-ELSE, but the most commonly used form is IF-THEN.

The purpose of using these expert systems is to reach a conclusion, find a solution or take a decision. The EXSYS Professional term for these conclusions/recommendations is the concept CHOICES (alternatives-aims).

In the previous examples "***Decrease acquisition price for fuel***" and "***Increase acquisition price for fuel***" represent CHOICES for the expert system and they are positioned in the THEN/ELSE part.

When employing rules in order to obtain conclusions/recommendations, answers are necessary as they are taken over by users through specialized interfaces or through interfaces with other external programmes. Thus, this knowledge of the system is stored and, subsequently, evaluated by using the rules.

In cases when the condition in the IF part of a rule is true, the knowledge concepts corresponding to THEN are activated. In an opposite scenario the ELSE part is activated with its corresponding knowledge concepts. In cases when the ELSE part does not exist, the next rule in the decision tree will be considered.

The EXSYS generator uses two types of facts (concepts/situations of knowledge): *qualifiers* and *variables*.

Qualifiers are known as the concepts of knowledge that allow the user to select one or more figures from a list predefined by the team of experts and the cognotician.

The general rule is that when a qualifier is created the concept of knowledge is conveyed as a text that ends in a verb.

For instance, if we develop an expert system in order to determine the maintenance capacity of a

logistics base, it will have to contain information on the level of technical resources.

Thus, we have to create a qualifier shaped as: "***the maintenance capacity is:***"

1. very good;
2. good;
3. satisfactory;
4. unsatisfactory.

The text "***the maintenance capacity is:***" constitutes the body of the qualifier and the types of capacity 1, 2, 3, and 4 represent the values rendered to it.

We need to mention the fact that the technique of using qualifiers is very frequently used in the creation of expert systems because it allows the reception of answers from the user in a rapid and unitary manner contributing to a remarkable flexibility in expert system development.

Variables will allow the user to introduce numbers or rows and they can be adopted by specialized interfaces from program-products/ external applications or even Hypertext elements. It is necessary for any newly created variable to be previously defined. The application of this procedure is important because the describing text is taken over and presented to the user as the completion of the standard message "Please input a value for the variable". The name of a variable is written between straight brackets and the attached message explains this name.

For the field of logistic services (catering, equipment, etc.) we are going to present examples of qualifiers that refer to the lifespan of a product.

The *Body* of the qualifier is "***The life cycle is"***, and its values could be: 1. launching; 2. increase; 3. maturity; 4. decrease; 5. don't know.

According to this example the qualifier looks like this:

"***The life cycle is"***:

- launching;
- increase;
- maturity;
- decrease;
- don't know.

The use of expert systems in logistic decision making is recommended in peacetime and in other situations, especially in the field of services, procurement and transportation.

The main argument in its favour is that military units/battalions have already created data bases which can be partially completed or updated through the Internet.

In order to consolidate logistic decision making, these systems can be implemented in most fields of logistics, some examples where these systems are already being put to use are logistic bases/ support battalions, respectively, through the public acquisition structures with the development of the marketing function.

We consider that the implementation of information technology on the level of logistic structures offers managers numerous advantages, some of which are the following:

• a faster process of decision making, that can serve as a reference model applicable to the functional domains of military logistics;

• the increase of quality in decision making;

• the possibility of trial and simulation of possible alternatives;

• the development of the informational flux through the optimization of procedures: logistic actions- information- logistic decision;

• the accomplishment of logistic objectives through the increase of management performance.

ACKNOWLEDGEMENTS

This paper has been financially supported within the project entitled "Horizon 2020 -Doctoral and Postdoctoral Studies: Promoting the National Interest through Excellence, Competitiveness and Responsibility in the Field of Romanian Fundamental and Applied Scientific Research", ***contract number POSDRU/159/1.5/S/140106. This project is co-financed by European Social Fund through Sectoral Operational Programme for Human Resources Development 2007-2013. Investing in people!***

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