Financial Diagnosis Expert System

Claudia ISAC
University of Petroşani

Specialists consider a financial diagnosis necessary for measuring the profitableness of invested capital and for estimating the economic and financial equilibrium, which has a certain influence on the economic, financial, and bankruptcy risk rate. Thus, the main purpose of any financial diagnosis is to point out the financial state of the company in order to identify possible causes and effects. A financial diagnosis starts with determining and interpreting a set of economic- financial indicators, which are calculated based on the financial balance sheet.
Keywords*: expert system, database, rule base, fact base, financial diagnosis.*

In specialized literature there are several definitions for *expert* **systems,** each of them pointing out that these are intelligent systems based on the symbolical representation of information, and implemented on a hardware characteristic for the application, which processes a lot of information in order to solve difficult problems in case of difficult activities, just like human experts. Therefore, we can say that software systems are decision software that comprises more or less information of a human expert.

Numerous *expert* systems designed to solve problems from different field can be classified as follows:

- According to **the purpose of their design**: *expert systems with a data base inferred from structural, functional or typological analysis* of strategic or dynamic behaviours of the managing process*; expert systems for modelling complex phenomena* the configuration of which is very difficult to be made by human experts because of the many concentration and formality possibilities and which depends on the problem to be settled*; expert systems designed to solve problems* that use both algorithms and heuristic methods in reaching a solution, thus, the information representation is based on functional or typological analysis;
- According to the **analogisms used**: *determined expert systems* that use fixed rules to reach a conclusion from an assumption; *probable expert systems* which link conclusions with probabilities that take into consideration some aleatory factors used in analogisms; *fuzzy expert systems* which use heuristic methods in making analogisms when the analyzed processes are not well known;
- **From a functional point of view**: *systems that help the user in a structural selection* of conclusions for real problems; *systems that underlie the solving process* by reaching the final conclusion with every detail; *systems that offer a large number of solutions for real problems* as a result of the interaction between the user's qualitative data and the quantitative data of the hard-soft functional structure;
- According to the **type of operation**: *ready-to-use expert systems* with a data base that can be used by inexperienced users; *specialized expert systems,* which return to the beginning or to the middle of the data base as they are unfinished soft made for a specific application; *expert system generators* which are not real soft but instruments that generate specialized *expert* systems.

As a whole, *expert* systems are a unique and modern technology, adopted very rapidly by big enterprises due to the flexibility and efficiency of economic activities and to an increases productivity that brings about substantial profit. Therefore, managers have to define a clear strategy regarding the opportunity to use *expert* systems in solving complex decision problems; they also have to analyze the alternative of whether to keep he existing software – a less expensive solution for the time being – or get hold of new equipment and software. In case they choose to implement new intelligent systems, managers have

to take into consideration some expenditure from the following budgets: the budget for purchasing equipment needed for development; the budget for development preparation (hardware purchase budget, the budget for setting up teams, etc.); the design development budget; the budget to correct, add or modify previous phases (modifying the teams, replacing the hardware, new methodologies), including new tests that need to be run; the actual development budget; hardware purchase budget for the final user to operate the software system; the implementation budget (users' training, approving and initiating the software, system maintenance); the soft evaluation budget. According to these data, we can compare the conclusions reached after implementing software systems in management; thus, we are able to make efficient calculations, which will later be used by managers in deciding whether to implement software systems or not.

The number of software systems, as well as the various fields they are used in have increased lately because of the advantages they offer: *performance* – software systems do not lose their data in the long run, they are able to function permanently; *the possibility to multiply them* – one can easily make copies of a software, while training new human experts is more expensive and it takes a long time; *efficiency* – implies lower costs compared to an expertise made by man; *consistency* – similar activities are handles in the same way; *objectivity* – the soft cannot be influenced, unlike human expert that can be subjective; *documentation* – a software system can offer permanent information in the decision process; *working speed* etc.

The impact of computers upon the company depends, in the first place, on the type of problems needed to be solved, economic or technical problems, respectively, and the level at which they are used. The implications of computers in the economic field can be divided into: *the impact upon the decisional process* as the decisions made by these systems are not influenced by personal emotions and they are consistent, that is to say that keeping to precise established standards, all hesitant manifestations when making a decision in the same context are gone; *the impact upon the organization structure* in a company which has three levels of management, top, middle and inferior, respectively, as many of the decisions made by middle management can be eliminated because decision roles and responsibilities can be divided among managers.

More and more specialists point out three phases in the evolution of *expert* systems in management, phases that are linked to a certain type of software used especially in decisional activities. At first, in management, computers were used to automate some routine and administrative activities in order to create *decision systems* more or less complex that encouraged and replaced the person making the decision, thus providing us with the possibility to test various alternatives and design new models. These systems have been used a lot, on the one hand to create data basses through which users can have ready access to different information, and on the other hand as decision evaluation systems based on performance criteria and systems that make decisions using estimations.

Next, there are *base expert systems* – open systems which can be updated according to the changes and developments in the field.

The third phase is characterized by hardware equipped with artificial intelligence also called *management systems,* which is considered the most modern information technology. The tendency is for these systems to comprise more *expert* systems for different fields of activity by introducing a data base system. The objectives the management system has in view are: to reduce risks, to stimulate creativity, to get involved in decision making and through its filtration and information gathering possibilities and results, the company can be dynamically managed.

Within these systems there is diagnosis analysis expert systems - management software used in financial diagnosis. Specialists consider a financial diagnosis necessary for measuring the profitableness of invested capital and for estimating the economic and financial equilibrium, which has a certain in-

fluence on the economic, financial, and bankruptcy risk rate. Thus, the main purpose of any financial diagnosis is to point out the financial state of the company in order to identify possible causes and effects. A financial diagnosis starts with determining and interpreting a set of economic- financial indicators, which are calculated based on the financial balance sheet.

In order to do a financial diagnosis, a expert system can be created that calculates and analyses the following indicators, according to their value: general liquidity, current liquidity, at sight liquidity, general solvability rate, financial independence, trading capital, necessary trading capital, net treasury, debt rate, immobilization evaluation.

This financial diagnosis system expert is a standard soft with the following elements:

- A *database* with all the specialized data introduced by man. This information is a description of the characteristic fields, of the relations between them, of particular cases, exceptions and resolving strategies, as well as a set of application conditions. This database can be done by storing information in using the software that has the role of gathering, calculating data about circulating assets, current assets, treasury assets, immobilization assets, permanent capital, base capital, outstanding debts, treasury credits, current debts, service debts, etc.

Table 1

Setting score to the Analysis Expert System Calculated Indicators

No.	Indicator	Values	Setting Score
1	General or current liquidity	$L_g \geq 200\%$	1
		$200\% > L_g \geq 150\%$	0,75
		$150\% \succ L_g \geq 100\%$	0,50
		$L_g \prec 100\%$	0
2	Immediate liquidity or acid test	$L_i \geq 80\%$	1
		$L_i \prec 80\%$	0
3.	On seen liquidity	$L_v \geq 20\%$	1
		$L_v \prec 20\%$	0
4	General solvability rate	$R_s \geq 20\%$	1
		$R_s \prec 20\%$	0
5	Financial independency	$I_f \geq 50\%$	1
		$I_f \prec 50\%$	0
6	Bearing fund	$FR \geq 0$	1
		$FR \prec 0$	0
7	Bearing fund necessary	$NFR \geq 0$	1
		$NFR \prec 0$	0
8	Net treasury	$TN \geq 0$	1
		$TN \prec 0$	0
9	Debts rate	$R_d \leq 50\%$	1
		$50\% \leq R_d \prec 60\%$	0,50
		$R_d \geq 60\%$	0
10	Assets evolution	$\Delta_i \succ 0$	1
		$\Delta_i \leq 0$	0

➢ *A rule base* contains rules that link fact. In order to analyze the financial situation, the rule base has some restrictions, which attach a value to each indicator, estimated according to the period of time in which they vary (tab.2).

Table 2

A rule base of the financial diagnostic expert systems

Logic Block: Score Calculus		
1 [Lg] >=200	10 --> [Score] = 1	20 --> [Score] = 1
2 --> [Score] = 1		21 [TN] >=0
3 [Lg] >=150	11 [Lv] >=20	22 --> [Score] = 1
[Lg] >=150	12 --> [Score] = 1	
4 [Lg] <200		23 [Rd] <=50
5 --> [Score] = 0.75	13 [Rs] >=20	24 --> [Score] = 1
6 [Lg] <150	14 --> [Score] = 1	25 [Rd] >50
		[Rd] >50
[Lg] <150	15 [Ifin] >=50	26 [Rd] <=60
7 [Lg] >=100	16 --> [Score] = 1	27 --> [Score] = 0.5
8 --> [Score] = 0.5		
	17 [FR] >=0	28 [Delta_I] >0
9 [Li] >=80	18 --> [Score] = 1	29 --> [Score] = 1
	19 [NFR] >=0	

➢ *A fact base* contains positive information in order to analyze the specific field and it processes the data introduced by the expert using the rule base. Thus, the financial diagnosis soft calculate the following set of indicators: trading capital, necessary trading capital, financial independence, the volume of investments, general or current liquidity, the acid test, debt rate, general solvability rate, net treasury (tab.3);

Table 3

A fact base of the financial diagnostic expert systems

Command Block: Indicators Calculus

```
1 SET [Current_Assets] [Stocks]+[Bonds]+[Anticipate_Expenses]
2 SET [Running_Circulating_Assets] [Current_Assets]
3 SET [Lg] ([Current_Assets]/[Current_Debts])*100
4 SET [Li] (([Current_Assets] - [Stocks])/[Current_Debts])*100
5 SET [Lv] ([Treasury_Assets]/[Current_Debts])*100
6 SET [Total_Assets] [Immobilized_Assets]+[Current_Assets]+[Treasury_Assets]
7 SET [Rs] ([Total_Assets]/[Current_Debts])*100
8 SET [Total_Passive] [Permanents_Capitals]+[Current_Debts]+[Treasury_Credits]
9 SET [Ifin] ([Proper_Capitals]/[Total_Passive])*100
10 SET [FR] [Permanents_Capitals]-[Immobilized_Assets]
11 SET [NFR] [Running_Circulating_Assets] - [Running_Debts]
12 SET [TN] [FR] - [NFR]
13 SET [Total_Debts] [Current_Debts]+[Treasury_Credits]
14 SET [Rd] [Total_Debts]/[Total_Assets]*100
15 SET [Delta_I] [I1] - [I0]
16 DERIVE CONF
17 DISPLAY "C:\Program
Files\Exsys\CORVID\Samples\Diagnostic_Analysis\results"
```

➢ The inferences motor operates the database, works out analogisms that deduce new facts and adopts decisions for modifying databases in succession until all the rules have been used up or until a conclusion is reached (tab.4).

Table 4

The inferences motor of the financial diagnostic expert systems

Rules:

Block: Score Calculus Row:2
IF:
[Lg] >=200
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:5
IF:
[Lg] >=150
AND: [Lg] <200
THEN:
Setting_score: Confidence = 0.75

Block: Score Calculus Row:8
IF:
[Lg] <150
AND: [Lg] >=100
THEN:
Setting_score: Confidence = 0.5

Block: Score Calculus Row:10
IF:
[Li] >=80
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:12
IF:
[Lv] >=20
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:14
IF:
[Rs] >=20
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:16
IF:
[Ifin] >=50
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:18
IF:
[FR] >=0
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:20
IF:
[NFR] >=0
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:22
IF:
[TN] >=0
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:24
IF:
[Rd] <=50
THEN:
Setting_score: Confidence = 1

Block: Score Calculus Row:27
IF:
[Rd] >50
AND: [Rd] <=60
THEN:
Setting_score: Confidence = 0.5

Block: Score Calculus Row:29
IF:
[Delta_I] >0
THEN:
Setting_score: Confidence = 1

Thereby, the financial diagnosis soft will calculate the final value that characterizes the financial situation and allows the analyzed company to be integrated in a category according to the total score (TS) reached: if TS is less than 5.5, then the financial state of the company is weak; if TS is more or equal to 5.5 and less than 7.5, then the financial state of the company is satisfactory; if TS is more or equal to 7.5 and less than 8.75, then the financial state of the company is good; if TS is more than 8.75, the financial state of the company is very good.

Bibliography:

1. Andone I., Mockler R., Dologite D., Ţugui A. – *Dezvoltarea sistemelor inteligente în economie. Metodologie şi studii de caz*, Ed.Economică, Bucureşti, 2001
2. Dumitrescu M. - Principiile inteligenţei artificiale, Ed.Albastră, Cluj-Napoca, 1999;
3. Dragotă V. ş.a. – *Management financiar*, Ed.Economică, Bucureşti, 2003
4. Dura C., Isac C. – Economia întreprinderii, Ed.Universitas, Petroşani, 2006
5. Tacu A., Vancea R., Holban Ş., Burciu A. – Inteligenţa artificială. Teorie şi aplicaţii în economie, Ed.Economică, Bucureşti, 1998