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THEORETICAL AND EXPERIMENTAL RESEARCH ON THE USE OF EXPERT SYSTEMS (ES) IN ASSESSING RISKS OF FAILURE IN METALLURGICAL COMPANIES

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The systems' engineering has reached an explosive development of intelligent systems technology which solves complex problems based on human expertise accumulated in the past and following the processes of learning and reasoning very similar to those of the biological brain. In this article, the concept of the proposed expert system is the result of interdisciplinary researches (computer science, management, accounting and business administration, etc.), which are designed to provide a tool for top management work force of a listed metallurgical company. The inference machine will provide in the end score functions for Altman, Conan Holder model and rating which eventually can be combined into a single model that will forecast the company's evolution in coming years.

Key words: metallurgical company, risk assessment, expert system, economic analysis, Altman model, Conan-Holder model

INTRODUCTION

Technical analysis represents one of the options for monitoring long-term trends and for predicting future development [1]. Artificial intelligence offers a new dimension in the concept of system automatization [2].

On the other hand, systems engineering has recorded an explosive development of intelligent systems technology, which solve complex problems based on human expertise accumulated in the past and following the processes of learning and reasoning which are very similar to biological brain [3].

On one hand we discuss about the existence of dozens of distinct areas in which we find major applications of intelligent systems technology (examples of areas such as economics, chemistry, biology, etc.), and on the other hand, we discuss about almost an extreme diversification in global components called "smart technology systems" [4].

This paper describes the theoretical issues and the applicability of expert systems in metallurgy, especially in the estimation of default risk. Thus, we considered that in real economy, - valid notice for business organizations in Romania -, there is a problem of great complexity, but rather "narrow", the problem of estimating the risk of bankruptcy and predicting the company's health for the following years. It should be noted that on a global scale (U.S.A, Italy, France etc.) were present during the last two decades, significant concerns in the application of Artificial Intelligence (AI) techniques to estimate the risk of bankruptcy of companies, but concrete results, as statistical report, were and remain very small [5].

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PROBLEM DEFINITION

The metallurgical company holds an important position in the steel industry in Romania and has organized the accounting according to the requirements of listed companies (standards, legislation, etc.) and of the International Accounting Standards (IAS)/ International Financial Reporting Standards (IFRS). The data used corresponds exactly with the metallurgical company's records from 2005 to 2011; there are four main accounting documents from which were taken important economic data (explicit knowledge in proportion of 94 % of the total volume and tacit knowledge in proportion of 6 % of the total volume): balance sheet, profit and loss account, informative data and the situations of fixed assets. The knowledge base itself comprises a data base containing facts about the problem and a set of specialized inference procedures called knowledge areas (KA) [6].

When structuring ES architecture I took into account the "3" economic models which can be combined in an ES application (Altman model, Conan-Holder model and Rating).

Below, there are the five specific operations for implementing the proposed ES [7]:

1) the creating procedure/ the updating procedure of the variables (table Var.DBF) as shown in Figure 1;

2) shown in Figure 2 an example the creating procedure/ the updating procedure of the goals (table Choice. DBF);

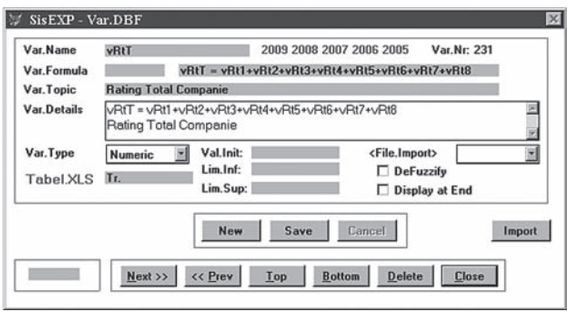


Figure 1 Window Edit for Var.DBF

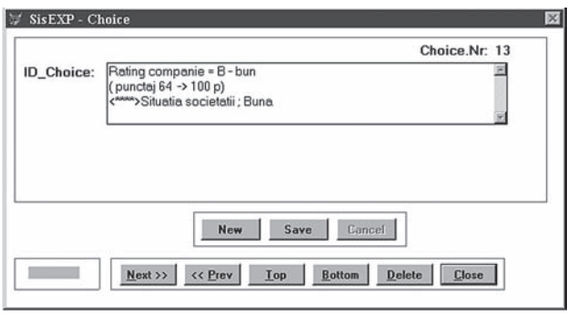


Figure 2 Window Choice

3) the creating procedure/ the updating procedure of the qualifier (table Qualifier.DBF);

4) while Figure 3 shows an example the creating procedure/ the updating procedure of the rules of type expression (table Expres.DBF);

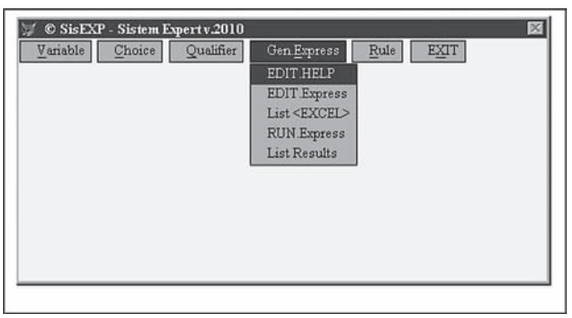


Figure 3 Generating expressions

5) the creating procedure/ the updating procedure of the rules of type rule (Rule.DBF).

Theoretically, implementing an expert system for solving a complex decision problem type (in medicine, economics, chemistry, etc.) can be built on real or hypothetical data defining the problem in detail [8]. If the expert systems are applied to economics, it must be taken into account that some technical issues of production, internal management, organizational management accounting, are structured in time as a "know-how" and are protected in the form of trade secrets; the top management of a listed company, such as the metallurgical company analyzed will not provide public information of the nature of the "know-how" discussed above.

Figure 4 contains Express/Conan-Holder model formulas.

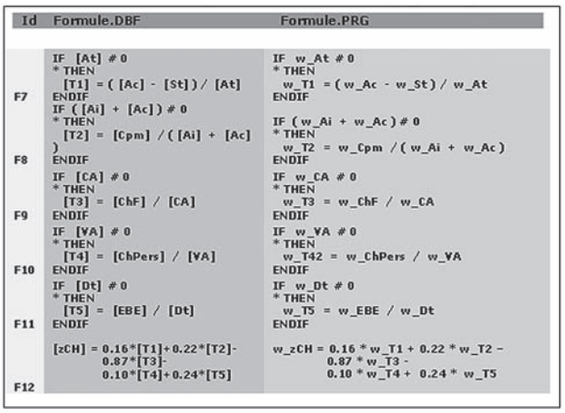


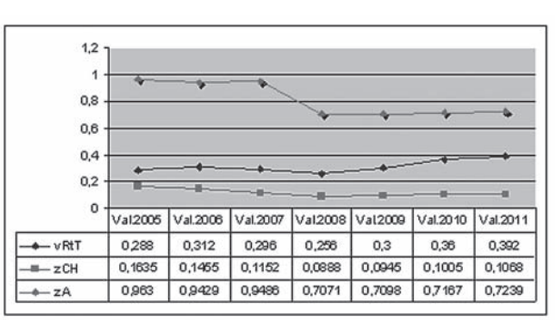
Figure 4 Generating expressions of model Conan-Holder

According to the research carried out, the expert system integrates two broad technologies, namely the database and expert systems.

RESULTS

Estimating the default risk associated with a company has always been and remains a highly complex problem, being given the large number of random factors that can influence the course of the company's life (economic situation, various crises, market conditions, technological developments, changes in income, bankruptcy of a major customer, etc.). Although each of the three models is based solely on information from accounting, the display for each Altman, Conan-Holder and Rating model, becomes invaluable aid to top management.

Obviously, the three score functions known under the form of zA, zCH, zRT may be included in a single graphical structure as shown in Figure 5; it can be assumed that we finally came to a synthetic structure that puts in a comparative method three distinct score functions specific to the three economic models.



	Val.2005	Val.2006	Val.2007	Val.2008	Val.2009	Val.2010	Val.2011
vRtT	0,288	0,312	0,296	0,256	0,3	0,36	0,392
zCH	0,1635	0,1455	0,1152	0,0888	0,0945	0,1005	0,1068
zA	0,963	0,9429	0,9486	0,7071	0,7098	0,7167	0,7239

Figure 5 The Evolution of scores for the three models

The financial statements of this company were taken from 2005-2011. The evolution of the company is given by the three models that have been processed by the inference machine.

By combining the three models it can be noticed that Conan-Holder and rating model have the closest values

duet o the fact that they use the same economic and financial indicators.

The Altman model uses other financial indicators and thus the graphic is different.

From the analysis of the three models is observed the Alro company's trend and the measures to be taken by the company's management in the coming years [9].

The expert system can combine the Altman, Conan/ Holder and Rating model based on existing accounting information in the accounts of these companies is comparable to that metallurgical companies.

CONCLUSIONS

Among dozens of factors that influence the firm during (and whose influence is not found at all or at most 1 % in the accounting firm), the following factors [10] are included:

F1 – macroeconomic cycles
F2 – number and relationships with customers
F3 – number and relationships with suppliers
F4 – access to capital
F5 – the legal protection of company
F6 – public support
F7 – competition in the sector
F8 – "games" of interest
F9 – management's attitude to cash flow
F10 – quality and training of managers
F11 – quality and training other employees
F12 – theoretical management of reporting
F13 – control over stock level
F14 – firm's position on the market
F15 – customer credit policy
F16 – provider of credit supply
F17 – staff costs
F18 – accounting system applied
F19 – "history" of the period covered
F20 – research, innovation and entrepreneurial attitude
F21 – launching in business opportunities
F22 – made factor that retain influence by other factors not reflected

Obviously, for the ES to capture, retrieve and process the influence induced by the factors F1, F2, ..., F22 on SSF it will require that each factor to be decomposed or derived as a tree with as many layers / nodes in Figure 6:

Therefore, the optimal solution will be possible by designing a new ES based on fuzzy logic, this, being the only mechanism through which can be captured, described and defined the characteristics that give content

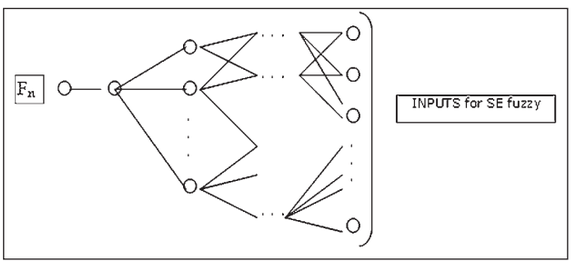


Figure 6 Derivation of factors F1, F2...F22

of each of the factors F1, F2, ..., F22. Finally, the fuzzy ES would provide a function score comparable to the function of the Altman or the Conan-Holder model (the outcome of SisEXP), which will be simply combined with the result provided by SisEXP; the final solution will be interpreted by the top management of the company. The complete financial analysis takes into account an economic problem of great complexity, problem that has preoccupied and still preoccupies the theory of "economics" on a global scale over the last century or more.

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Note: The responsible for English language is the lecturer from Faculty of Economics, Suceava, Romania