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AN EXPERT SYSTEM APPROACH IN STOCK SELECTION ATTRACTIVE FOR INVESTMENT

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ABSTRACT
Expert systems are the most important part in the field of artificial intelligence. This universal technology for representation expert knowledge into valuable computer program may be implemented in different scientific fields such as engineering, law, economy etc. Knowledge engineering has to elicit knowledge from domain expert and transform it in shape applicable for languages of artificial intelligence or shells prepared for load production rules. In this paper is implemented the expert system methodology for supporting decisions in stock selection. Special focus and attention is given to domain knowledge distributed to many experts in finance, accounting, management, mathematicians. In building knowledge base of expert system EXFIN is implemented logical programming (programming langue Visual Prolog). Visual Prolog has shown satisfactory implementation and application power. Special property of expert system EXFIN is modularity and openness for further extension and improvement.
Key words: expert systems, business excellence, financial analyze

1. INTRODUCTION
Stock selection attractive for investment is a complex theoretical and practical task in economy. If individuals or enterprise develops adequate and validated model of stock selection for building up the portfolio than the positive economic consequences are of enormous importance for sustain and development. Key question is how to determine the performance measure of companies on market and distinguish the successful from bad companies unattractive for investment. How to recognize the companies with positive trends in the levels of organization, the increase in market share, profitability, activity, liquidity among the all at financial market? Economic theory answers on this fundamental question by construction a large set of economic indicators adapted to reflect the economic position from different points of view. Financial expert posses the knowledge based on his experience and often may be extracted (or elicited) only by interviews not from literature. As a result of our interaction and interviews with domain knowledge expert in finance we have defined the set of five indicators for forecasting the economic power and strength the company in the future period. Interviews with helped us to make adequate judgment and build up the set of indicators of company performance. There are many examples of expert systems for measuring company performance by finding the causes of current business situation and predicts its future [1], or building a network of expert systems for forecasting, planning and management of business systems [5], or taking into account factors that can increase or decrease the sales and revenues[6].
There are also many attempts to discover the secrets of capital markets [2] and presenting the methodology for equity selection using financial analysis [6].

2. EVALUATING CORPORATE PERFORMANCE

A financial analysis for evaluating corporate performance is first and critical step in development methodology for classifying companies into one of four groups: most attractive, attractive, satisfied and not attractive for investment. Financial theory today offers a large set of indicators for assessment of business position and strength of companies [3]. There are many indicators that can be classified into five groups: profitability, activity, liquidity, debt and position on financial market.

Profitability may be expressed as:

$$\text{Return on Asset} = \frac{\text{Net profit}}{\text{Assets}}$$ or income before tax and interest/asset,

Liquidity as: $$\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}},$$

Activity as: Total asset ratio= $$\frac{\text{Total sale}}{\text{Total assets}},$$

Debt as: Total debt ratio= $$\frac{\text{Total liabilities}}{\text{Total Assets}}$$, and

position on financial market as: Price to earnings ratio= $$\frac{\text{Market price per share}}{\text{Earning per share}}$$

where the denominator is Earnings per share= $$\frac{\text{Net income}}{\text{Number of common shares}}$$.

In literature and practical solution exists various methodologies for evaluation the strength and performance the companies on market. For example, one methodology first classifies all the companies into groups (classes) depending on their corresponding industry [6]. Then follows application expert system methodology separately in each of class and finally partial results are integrated. Proposed methodology is complex because for each class is necessary assess the thresholds and evaluation steps.

We proposed relatively simple but effective methodology for evaluating performance. We propose that the goal of investments into securities is dividend and potentially influence on management and decisions. Speculative motives of investments are not considered (speculative means buy to sell more expensive).

Therefore we consider the five indicators in dynamic way and compare two successive values into two time periods t_1 and t_2. If the ratio of one indicator in two times period is greater than one (e.g. for profitability) may be concluded that the financial position and performance is increasing.

If the ratio is one or less than one that means the financial position and economic performance is decreasing.

Because we select five indicators there are 2^5=32 goal states. The number of indicators may be greater than five (e.g. *n*) and consequently the number of possible states is increasing as exponential function (2^n). For example, for companies attractive for investments there are only four production rules presented in the next table:

Table 1. Production rules in EXFIN knowledge base

Rule number	Profitability (P)	Activity (A)	Liquidity (L)	Debt (D)	Market (M)	Class
R1	<=1	>1	>1	<=1	<=1	Attractive
R2	>1	>1	<=1	<=1	<=1	Attractive
R3	>1	>1	>1	<=1	<=1	Attractive
R4	>1	>1	>1	<=1	>1	Attractive
……	……	….	…..	….	….	……
R31	<=1	>1	<=1	<=1	>1	Non attractive
R32	>1	<1	<1	<=1	>1	Non attractive

These quantitative criteria are calculated directly from balance sheet and income statement. These values are entering into database and knowledge base of expert system EXFIN extracts these values and makes corresponding conclusion – attractiveness for investments.

3. EXFIN EXPERT SYSTEM

The code name of our expert system for stock selection is EXFIN and its main task is to classify all companies at financial market in one of four groups (one company may belong only to one group and one group may contain one, two or more companies – mapping N:1). The knowledge base of EXFIN is consisting of 32 production rules representing by clauses in Visual Prolog 7.2. As was mentioned earlier the clause tests the value (dynamic indicator) of five indicators:

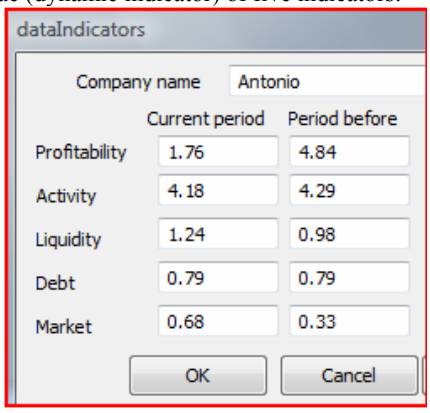

Figure 1. User interface for entering data into database

The user enters data for each one company into database described by:

```
class facts  - indicatorsDB
indicators:(string Copmany_name, real Profitability,  real  Activity,  real  Liquidity, real  Debt, real  M
arket).
```

The clauses for inserting the record (row or tuple) into database table (predicate assertz() will add the data at the end of table) and save data into database Ana.txt (predicate save()) are:

```
 clauses
 addIndicators(Copmany_name, Profitability, Activity, Liquidity, Debt, Market) :-
      assertz(indicators(Copmany_name, Profitability, Activity, Liquidity, Debt, Market)),
      stdio::write("Company ", Copmany_name," is added data."),
      stdio::nl.
saveDatabase() :-
       file::existFile("Ana.txt"), !,
       file::delete("C:Ana.txt"),
       file::save("C:Ana.txt", indicatorsDB),
       stdIO::write("Database is storing into file Ana.txt"), stdIO::nl.
   saveDatabase() :-
       file::save("C:Ana.txt", indicatorsDB),
       stdIO::write("The records are in database Ana.txt"), stdIO::nl.
```

After entering values of indicators Profitability, Activity, Liquidity, Debt and Market for all companies the database Ana.txt is populated with necessary data and stored on hard disk. For selection and classifying companies is necessary to read data into main memory what does the next clause:

```
fileRead():-
file::consult("Ana.txt",indicatorsDB),
stdio::write("The file Ana.txt is red from hard disk. ").
```

The knowledge base of EXFIN for selection the best companies for investments includes 32 clauses (we show only one clause):

```
prikazNoAttractive():-
        indicators(Cn, P, A, L, D, M),
       ( P>1,A<=1,L<=1,D<=1,M>1),
        stdio::write("According to corporate performance there is no interest for investments in: ", Cn),
       stdIO::nl,
      fail.
prikazNoAttractive().
```

The knowledge base includes all production rules needed for recognize the investment opportunities. There exist besides most attractive and unattractive companies also two more classes: attractive and satisfied, represented by production rules.

Database may be populated not only by direct entering the values of indicators for performance measurement from EXFIN but as e result of SQL statement applied to relational databases. Data in balance sheet and income statement are data source for calculating the indicators. Expert system EXFIN is very simple integrate with data warehouse and relational databases.

4. CONLUSION

In this paper is presented clearly the knowledge base of EXFIN expert system which analyses the set of corporate performance indicators and classifies companies to most attractive, attractive, satisfied and unattractive for investment. Finally decision lies on manager but the EXFIN output is key information base for making lower risk decisions. EXFIN expert system is possible to extend very easy. Namely, knowledge base can incorporate six, seven, ten or more performance indicators. Adding new production rules means the extension the knowledge base without change the main idea: the value of indicators is condition part of production rule and the class is action part of production rule.

Visual Prolog 7.2. has shown extraordinary application and development power. The future research may be concentrated on extension EXFIN knowledge base and building optimal stock portfolio consisting from securities of selected companies.

5. REFERENCES

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