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Abstract: Expert systems which are used in evaluating the credit-worthiness of firms applying for credit lending services of the banks, are researched. This research was done in three major steps: 1) survey of expert systems in financial banking; 2) identification of disadvantages and problems of expert systems, and; 3) proposals of knowledge sharing systems to overcome these disadvantages.

APPLICATIONS OF EXPERT SYSTEMS AND KNOWLEDGE
SHARING SYSTEMS TO FINANCIAL PROBLEMS IN
BANKING AND CREDIT LENDING

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1. EXECUTIVE SUMMARY

In this paper, expert systems which are evaluating the credit-worthiness of the firms applying to the credit lending services of the banks, are researched. This research has done in three major steps:

1) Survey of expert systems in financial banking

2) Identification of disadvantages and problems of expert systems in financial banking:

- Integrating the live data feed with the technical models and the knowledge base without losing the critical response time

- Difficult knowledge acquisition

- Limited system functions

- Expensive systems

- Computer-illiterate users

3) Proposing of knowledge sharing systems to overcome these disadvantages

II-INTRODUCTION

The beginning point of this paper is a credit market where banks face an adverse selection problem. The adverse selection problem is due to the existence of two types of firms which apply for a loan of fixed size. These two types differ in their ability to repay the loan. The banks' problem is then to assess an applicant's ability to repay the credit. In absence of self-selection or signalling, such as credit rationing, banks have to rely on active monitoring when they decide on the firm's application.

To determine the future ability of a firm to repay credit, which is called the credit-worthiness of the applicant, the banks' credit departments will use any relevant information it has available to assign the applicant to a certain risk class. It will be assumed that for any given applicant, a bank might make judgement errors, i.e. that a risk class may contain more than one type of applicants. Furthermore it will be assumed that for a given applicant the judgement errors will be independent among banks. Given this procedure for reducing but not totally eliminating the adverse selection problem, the banks will compete with each other by setting interest rates conditioned on their own test results.

Lending institutions can not afford spending more than a certain limited amount of time to investigate the application of each

applicant. Competition and increasing cost of information are the other reasons that a lender should approve or reject submitted applications in a reasonably short period of time with minimum decision errors.

Credit scoring has traditionally been used for the purpose of differentiating between good and bad borrowers. Today a majority of various financial institutions use some form of credit scoring. Credit scoring is basically a statistical method or model which measures quantifiable variables indicating the credit status of an applicant. These variables are extracted and selected based on the previous transactions. After the model is set, information received about a prospective borrower, usually provided by the applicant and verified through various sources are entered in to a computer model. This traditional approach is fast but prone to misjudgment, and is basically mechanical and not flexible enough to incorporate various qualitative factors or provide precise interaction with in and between qualitative and quantitative variables.

III. SURVEY OF EXPERT SYSTEMS IN FINANCIAL BANKING

The 1980s can already be seen as the decade in which the expert system technology developed in research institutions during the 1970s was first exploited on a substantial commercial scale. Naturally, the initial applications of expert systems were guided by the lessons of the 1970s, and made as much use as possible of familiar rule-based and frame-based representations that were first developed to address in medical and other technically oriented domains.

An important shift for the utilization of expert systems in business applications occurred between 1983 and 1985. Expert systems moved out of prototype development into the mainstream of industry. Of course, in many different places people are still in a prototype mode, but where expert systems have entered the mainstream, for example in the financial services of the banks, the experience provides a model and a methodology for systematically developing expert systems for other industry applications. We now have people with understanding and experience who have built a large number of expert systems.

People in the trading field felt that the areas where they needed expert systems technology or they felt expert systems technology had an impact were in foreign exchange trading, option trading strategies, trading risk assessment, pricing/analysis of data quality, and technical analysis/pattern recognition.

In investment banking, deal structuring was the activity that attracted people first to expert systems. The number of factors and the amount of data involved in putting a deal together was becoming unwieldy for human beings to do in a reasonable amount of time. Other application areas were in expert portfolio reviewing and business strategic planning.

In banking, interest in expert systems applications is equally spread among decision support systems for credit lending advisors, consumer and business loan reviews, credit scoring, and on line customer assistance.

IV. IDENTIFICATION OF DISADVANTAGES AND PROBLEMS OF EXPERT SYSTEMS IN FINANCIAL BANKING:

A) APPLICATION REQUIREMENTS:

As the application requirements were better understood, the design response led to a new architecture that departs sharply from the rule- and frame-based architecture that dominates expert systems today. My own interest centred specifically on the application to assessing commercial credit worthiness. This application is concerned with estimating or assessing numeric and symbolic quantities; on investigation involving comparable styles of reasoning; involving substantial amounts of case-specific, or transient data as well as permanent reference data; serving business users with comparable attitudes and needs; being largely self-contained and existing in the real world of commercial data processing with its attendant interface and operational requirements. These are the application requirements for the expert system for assessing commercial credit worthiness. (9)

Another feature of application is that the users agree that the users agree that the payoff is high and at the same time, have realistic expectations of what the system can do. The tasks to be performed by the expert system should be knowledge intensive, repetitive, easy (but not too easy), they should require little or no common sense and test cases should be available.

Finally, the human experts must be available and willing to cooperate.

B) PROBLEMS RELATED WITH FINANCIAL SYSTEMS:

1) FINANCIAL-ANALYSIS PROCEDURES ARE TIME CONSUMING.

A single analysis ranges from several hours to a few days depending on the complexity and cooperation. Contributing to the length of time credit analysts must spend is the nature of the data: financial statement data are voluminous; prone to error; and in a small percentage of the cases deliberately misrepresented.

2) RISK-ANALYSIS EXPERTISE REQUIRES YEARS OF EXPERIENCE AS WELL AS A THOROUGH UNDERSTANDING OF ACCOUNTING PRINCIPLES AND FINANCIAL ANALYSIS THEORY:

Most entry-level employees do not have educations in accounting or finance. Therefore, new analysts tend to concentrate on the ordinary tasks of the process, for example, ratio calculations.

C) PROBLEMS AND DISADVANTAGES OF EXPERT SYSTEMS:

1) INTEGRATING THE LIVE DATA FEED WITH THE TECHNICAL MODELS AND THE KNOWLEDGE BASE WITHOUT LOSING CRITICAL RESPONSE TIME:

This is the biggest technological problem in the credit lending advisor expert systems. The problem of integrating live data feed with the technical models and the knowledge base without losing critical response time is caused by the inconsistent knowledge. Unless the results can be quickly offered to the credit-analyst, the information is useless. A mechanism for improving models by applying what-if analysis and examining past history is needed. Live data is critical, and a sophisticated user interface that supported both text and graphics has to be designed.

2) DIFFICULT KNOWLEDGE ACQUISITION:

Like the other expert systems, also in financial areas such as credit lending, knowledge acquisition from experts is one of the biggest problems. Since the experts are not the knowledge suppliers, the expertise in management fields is generally decentralized among many managers in various positions.

3) LIMITED SYSTEM FUNCTIONS:

This problem is derived from the fact that system users are not novices; instead they are considered average managers. As they become accustomed to the ordinary expert system, they begin to find that the system answers are too limited or too predictable. This is because expert systems use inference mechanisms, which result in the answers from expert systems being within the set that consists of initial knowledge and knowledge that is obtained by the inference processes. (8)

In credit-worthiness analysis, an expert system model can be a good indicator in certain economic situations but terrible in others. Some models work well in tandem or in other words one after another but are not useful alone. There are some credit lending expert systems which has the great strength of being able to perform this multi-factored analysis in real time.

The knowledge base of these systems does not yet include rules about the unforeseen business, economic, and political events that influence the financial environment.

4) EXPENSIVE SYSTEMS:

The software system price ranges from half a million to several million dollars. Internal expenses of the purchasers make total installation cost rise above product price alone and each purchase is only made only after a sophisticated institution conducted a lengthy evaluation and analysis.

5) COMPUTER-ILLITERATE USERS:

Some credit analysts have inadequate computer knowledge for the process. That causes problems in the functioning of the expert system.

V. PROPOSING OF KNOWLEDGE SHARING SYSTEMS TO OVERCOME THE DISADVANTAGES

The knowledge base of credit lending advisor expert systems includes two elements:

1) Facts (explanatory variables) regarding credit applicants and other relevant information

2) A series of rules which constitute precise expert guidelines for evaluation of credit applications

The knowledge base in the model also contains two alternative actions as: accept the application and reject the application. Based on certain conditions regarding a particular application, either the application is accepted or it is rejected. When the expert is executed, the user is asked to answer a series of questions regarding the values of qualifiers related to a

particular credit application. The user responds to the questions by simply entering the selection number of values which are displayed on the screen. When the user is not sure why a question is being asked, he/she types "why" instead of the selection number. The system explains the reason by displaying the rules it is using and how the requested input will be used.

This user-system interface mode will continue until the system has reached the appropriate conclusion. The conclusion is based on the users input and the inference from the rule base. Then the system displays the result regarding the acceptance or rejection of the application. The result is displayed along with its probability or the degree of certainty.

The user may ask how a particular conclusion was reached. In this case the program displays the rule set used to arrive at that conclusion. Furthermore, the user can change one or some of the answers and rerun the program in order to test the sensitivity of the results to a particular answer by comparing the previous and the new results.(5)

The disadvantage of difficult knowledge acquisition and limited system functions shows that in management fields expertise is generally decentralized and hence managers are considered average rather than expert managers or novice managers. This indicates the paradigm mismatch between management fields and expert systems (consulting paradigm) that require experts (as knowledge

suppliers) and novices (as system users).

Proposing a knowledge sharing system the essence of it is that knowledge suppliers are the same set of system users who use the knowledge base. The primary purpose of this knowledge sharing system is for users to share and use knowledge that they have provided. System users share knowledge among themselves through knowledge bases.(8)

To solve the problem of difficult knowledge acquisition there have been various artificial intelligence R&D studies such as investigation of knowledge representation schemes and languages that help ease knowledge acquisition, development of efficient maintenance tools for a knowledge base, exploration of automatic acquisition tools, and implementation of effective interview methods with experts.(8)

The knowledge acquisition subsystem handles the knowledge transfer between the human expert and the expert system. This transfer of information is achieved through the use of an interactive interface between the human and the computer system. The explanation subsystem provides the means for explaining why the system reached a particular conclusion or why a particular piece of information is being requested. The user interface provides a query language (texture and/or graphical) through which the user communicates with the expert system.

(See appendix for the figures)

VI-CONCLUSION

Application of expert systems in credit evaluation has numerous advantages over the use of the traditional credit scoring techniques:

The user interface capabilities allow for a high level of interaction between the credit analyst and the expert system. The credit analyst or the lending officers are able not only to ask questions or verify the answer by requesting more explanation regarding acceptance or rejection of a certain application, but also do so through the use of natural language without having to know any programming language or remembering the syntax of a certain language.

One of the most interesting features of expert systems is preservation of knowledge of human experts. Application of expert systems in credit evaluation will result in knowledge acquisition and preserving judgemental information from experienced and knowledgeable credit officers who may leave the company in the future due to retirement or other reasons. Because of considerable shortage of experienced credit officers who can quickly and effectively evaluate credit applications, the bank may tend to hire less experienced personnel to do the job of an expert officer. This leads to a significant cost of inaccuracy and bad judgement which will result in rejection of some good applications and acceptance of some bad applications. Expert

systems compensate this shortage without compromising the credit evaluation process since they assist less experienced employees in performing the job of expert officers.(5)

Expert systems offer far more flexibility than the traditional methods of credit scoring. They are very user friendly and allow for a meaningful and convenient dialogue with users. Furthermore, the credit officers using expert systems can easily modify, add or delete variables and rules as necessary to handle special cases of credit evaluation.

Expert systems can also allow interface with other programs and data bases. It is therefore possible to import additional credit information required for further examination of applications by having direct access to other spread sheets and data base files.

The future of expert systems in financial services:

- Increasingly wide spread use of expert systems
- Increase in scope of expert system applications
- Integration of expert systems in to overall developmental environment
- Further evolution of domain specific tools
- Knowledge engineers specializing in domain applications
- Lower costs standard hardware used as tools become more capable
- Structured methodology approach applied to entire knowledge engineering process
- Reduced developmental costs due to comprehensive, stream-lined structured methodology approach

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