The Integration of Qualitative Factors into Expert Systems for Evaluating Agricultural Loans

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Abstract

The ever-changing economic environment is forcing banks to re-evaluate the way loan decisions are made. Several agricultural loan evaluation systems are operational, however, they are not 'true' expert systems. While they have all focused on analysing the borrower's financial position given the current market and economic conditions, most have not taken into account qualitative factors such as the character of the borrower. The purpose of this paper is to present an expert system that has been specifically designed and developed to incorporate qualitative and quantitative assessments in agricultural loan evaluation.

Keywords

Expert Systems, Banking Industry; Banking IS; Knowledge-based Software.

INTRODUCTION

Prior to financial sector deregulation, the banks were highly motivated to lend to clients who could demonstrate their creditworthiness. This situation was due to credit rationing and the bank's inability to adjust interest rates to reflect different degrees of lending risk (NAB 1990). With the implementation of the Campbell Committee's recommendations (1981) and those of the Wallis Committee (1997), banks are now in a better position to meet the demand for credit from customers. Since financial deregulation, however, Australia's economy is more vulnerable to the influence of external factors. The external factors, together with internal forces, have created constant shifts in the supply and demand for goods, services and money. Interest rates have accordingly fluctuated dramatically. Consequently, banks are undertaking riskier loans and seeking to incorporate the possibility of loan default into the interest rate charged. The outcome of this strategy has been an increase in the number of bad debts; some were inevitable as banks undertook lending for a broader range of purposes (NAB 1990).

All bank loans necessarily contain an element of risk. In order to minimise this risk, it is essential that procedures and control mechanisms are in place to ensure that each loan is objectively assessed and the bank's total loan portfolio does not compromise the bank's overall integrity. That is, the financial soundness of a bank is largely dependent on the riskiness of its loan portfolio. Deregulation provided the opportunity to meet the demand for credit across a broad range of borrowers. However, the boom-time advances in the 1980's and the resulting large number of bad debts will cause the banks to be overly cautious in extending credit (Boyd 1993).

Implementing computing technology for delivery of financial services is one way banks can reduce cost and possibility of loan defaults (Llewellyn 1995). Artificial Intelligence (AI) systems, particularly

expert systems, are computer-based technology finding a place in the banking industry. Expert systems are computerised advisory programs that try to imitate or substitute the reasoning processes and knowledge of experts in problem solving (Turban *et al*. 1998). It will analyse the problem, manipulate the encoded human-expert knowledge and provide a recommendation based on inference, heuristics and rules of thumb. That is, the system is based on a flexible, human-like thought process. Expert systems are of great interest to business and scientific communities because of their potential to enhance productivity and to augment work forces in areas where human experts are becoming harder to find and retain. Such systems can also be expected to improve the quality of the bank's asset base and increase overall profitability. Current applications are restricted to relatively limited and narrow areas of expertise.

OBJECTIVES OF THE STUDY

The application of expert system technology to agricultural loan evaluation offers an advance on human decision making capabilities. It provides an opportunity to put loan evaluation expertise at the disposal of non-experts. The objective of this research is to examine whether expert system technology is an effective and efficient means of providing advice and support for the agricultural loan evaluation process. The following sections will include a brief overview of rural debt, review basic credit considerations, analyse the agricultural lending process and demonstrate how expert system technology can be applied to loan evaluations. Applications of expert system technology to agricultural lending will then be described along with the limitations of such systems. An overview of an expert system that overcomes these limitations will follow.

RURAL DEBT

Rural sector incomes are highly susceptible to adverse economic and seasonal trends. Poor demand for rural commodities from export markets continues to result in low commodity prices for Australian farmers. At the farm level, farmers may again record losses although cash flows are at break-even or slightly higher (Shearer 1993). The erosion of the assets base that these losses are inflicting on agriculture is a threat to the long-term sustainability and viability of the rural sector. The erosion of the capital base is manifesting itself in a number of ways at farm levels including escalating debt, reduced soil fertility, poor pasture productivity and aging of farm plant and equipment (Shearer 1993).

During the 1980's, profitable farms were able to maintain a low debt to equity ratio. The decade also saw a number of farmers put themselves in a position of high exposure (Hall *et al*. 1991). Shearer (1993) attributed the failure of highly exposed farmers to excessive debt, poor prices and management problems. Farmers who recognised their position as risky often could reverse their plight and recover. The situation is unlikely to change in the late 1990's as farmers face an uncertain income stream that is further compounded by a decline in farm assets (Hutchings 1992, ABARE 1997). Farmers as well as banks must recognise the risks and once recognised, action should be taken to manage it. Credit assessment needs to be undertaken in the light of the current and prospective economic situation where both borrowers and lenders alike must be more cautious about increasing debt levels.

AGRICULTURAL LOAN EVALUATION

The decision whether or not to borrow funds is an important one for a farmer and cannot be treated lightly. However, it is the lending institution that ultimately determines borrower's creditworthiness

by making a judgement on whether a borrower possesses sufficient credit to permit the exchange of additional loan funds. The volume of applications has increased faster than the number of qualified personnel needed to service that volume effectively. Lending institutions want to avoid rejecting qualified applicants and accepting those likely to default on their loan. Beerel (1986) in developing a loan evaluation expert system identified several stages in the commercial and agricultural lending processes. The agricultural loan evaluation process, while similar to the commercial process, is approached from a different perspective. The order of evaluation of each stage of the process is different and emphasis is placed on other aspects. The agricultural lending process has nine separate stages: (1) Purpose of Loan; (2) Financial Analysis; (3) Debt Servicing; (4) Security Schedule; (5) Short-term Prospects; (6) Long-term Prospects; (7) Impression of Borrower; (8) Conditions on Loan; and (9) Monitoring and After-care. Since each application is in some respect unique, expert system technology can be applied to avoid making erroneous decisions.

The first stage reviews the purpose of the loan, for example to finance capital improvements, provide short-term working capital or for an absolute necessity (natural disaster). Consideration is also given to whether the stated purpose of the loan is necessary and pertinent to the industry sub-group (for example, beef, dairying, small cropping, etc.). The financial position of the client is then evaluated using the Statement of Position (Balance Sheet) and the Profit and Loss Statement. Security offered on the loan is then evaluated. This stage includes activities such as inspecting the property and determining market and security values of assets offered as security.

The future prospects of the borrower are evaluated in the next two stages. Past, current and future cash flow statements are examined to determine short-term viability. Debt servicing ability is determined through an examination of the long-term plans of the borrower and the conditions associated with the industry sub-group. For example, rules of thumb could be applied to determine whether expenses are in proportion to revenues. Impressions of the client and the loan application itself are evaluated in the following stage. At this point, a decision on accepting or rejecting the loan has been made. Special conditions to which the loan would be subjected are determined in the eighth stage of the evaluation process. The final stage relates to after care of the loan and monitoring progress of repayments and will only occur if the loan is approved.

ES AND LOAN EVALUATION

Expert system technology applied to commercial and agricultural lending combines credit knowledge and judgement of senior loan assessors with the ability to apply it selectively to a given client. By taking prospective client financial statements and projections, competitive position, managerial competence, qualitative information about the industry and other related elements, the loan officer can work with an expert system to identify and probe important issues, strengths and weaknesses. The expert system can help the officer analyse client credit worthiness by weighing qualitative information against operating performance, making forecasts against historical results and such. Since the technology applies expertise only in the context of each specific case, it can be more effective and thorough than static guidelines.

Coats (1988) identified five expert system features that make them particularly suited to loan evaluation. These features include the ability to recognise patterns, understand prose material; provide explanations on the path of reasoning used; incorporate uncertainty and remember large amounts of information. Pattern recognition is useful in loan evaluation when conducting a financial analysis (Stages 2, 3 & 4) and in assessing business prospects (Stages 5 & 6). As part of the evaluation process, the bank may wish to forecast the firm's financial position some years into the

future using economic, industry and market data. The system, by understanding prose material, allows the bank officers to input impressions of the client (Stage 7) and the presentation along with subjective evaluations of management strategies and repayment abilities (Stage 3). Uncertainty can be included in the financial analysis (Stages 2, 3 & 4) and in preparing repayment terms (Stage 8). The system can be used by loan officers to evaluate more loans during a single period than would otherwise be the case. At all stages, the system could provide explanations of the evaluation process that can be included in the loan documentation. These significant capabilities result in several benefits being realised.

The major advantage in automating loan evaluations is the improvement in the bank's lending record through the uniform application of credit and security guidelines. That is, the system will ensure awareness of and adherence to relevant bank policies. Behan *et al* (1987) identified several other benefits. Decision-making is more consistent and evaluations are more accurate that may result in more applications being accepted and fewer losses through defaults. An expert system can help develop experienced, productive loan officers more rapidly by improving their understanding of critical aspects of a business. Productivity increases of 8%-15% appear possible - with corresponding improvements in the credit area (Turner 1987). The use of expert systems should encourage the thorough and thoughtful analysis of new loan applications without the need for time-consuming supervision by more experienced officers. Lastly, the knowledge base is easily updated and maintained when the bank changes loan policies or the government alters credit regulations.

AGRICULTURAL LOAN APPRAISAL SYSTEMS

While there is an abundance of literature about ES, little pertains to the loan evaluation area of the banking industry. Development of commercial loan evaluation systems has occurred on three levels: operational expert systems (see Duchessi *et al.* 1988) prototype expert systems (see Duchessi *et al.* 1987, Ben-David *et al.* 1986) and expert systems that are conceptual (Iwasieczko *et al.* 1986). In evaluating the financial stability of farming businesses, expert systems should incorporate information on market and economic conditions to provide a current picture of the agricultural business and its financial performance. Many system being applied in the agricultural industries have been classified as 'financial analysis' systems. The philosophy underlying the development and use of such packages is that a better-informed decision-maker will make more consistent decisions and with reduced probability of making major financial mistakes. Sawyer *et al*. (1987) evaluated seven financial analysis programs widely used by financial institutions and primary producers in the United States of America. Gray *et al*. (1988) discusses the use of expert systems by non-bank consultants to assess the viability of a farming business. Four other financial analysis systems are described in the following sections.

A Financial Analysis Review Expert System (FinARS)

FinARS provides users with a simple evaluation of the financial health of a farm business. FinARS is designed to provide an initial assessment of the overall financial state of a farming business from basic information (Boggess, *et al.* 1989). The system can be used for teaching financial analysis concepts or as a diagnostic tool to provide an initial evaluation of the farm's financial situation, identify potential problems and suggest alternative financial improvement strategies. FinARS consists of four basic components, viz. liquidity, solvency, profitability and integrative evaluation components. Within each component financial ratio information, standards, rules-of-thumb and trend information are used to form the rules associated with the decision-tree structure. Input to the system can come from the keyboard or from a spreadsheet. FinARS will prompt the user to supply essential information if a

spreadsheet is not available or is incomplete. The system is able to link with spreadsheet data that can then be condensed by the system into brief written explanations and analyses. Formal evaluation of the system was undertaken using ten financial scenarios, ranked by the system on a scale of 1 (extremely bad) to 10 (extremely good). The same ten scenarios were presented to two financial experts for ranking and a high correspondence with FinARS' rankings was achieved.

Agricultural Financial Analysis Expert System (AFAES)

AFAES was designed to facilitate organisation and analysis of financial data of farms and ranches in the USA [McGrann *et al*. 1989]. The AFAES package includes a data entry program, a spreadsheet, three ES and a database management program. The spreadsheet package facilitates the preparation of operating-year and multi-year financial statements. Output presents financial ratios and their associated trends in tabular and graphical formats. The database management program facilitates the management of borrower documentation, financial data, lender standards and portfolio analysis. AFAES includes three separate ES that perform diagnostic analysis of a farm's current business performance, financial condition and projected performance. This analysis is similar to what one would expect from an agricultural financial analysis expert. A diagnostic interpretation of the historical, current and projected financial statement data is presented as part of the output analysis. The AFAES system was validated by presenting data from three representative farms to ten loan officers. Farm evaluations provided by AFAES and the loan officers were relatively consistent with respect to liquidity, solvency and profitability. There was some divergence in the appraisal of financial leverage and in repayment capacity.

A Financial Analysis System (FAS)

The Financial Analysis System (FAS) was developed by the Primary Industries Bank of Australia (PIBA) and provides a simple analysis of the financial health of an agricultural business. The system is designed to provide decision support when assessing the overall financial state of a farming business using quantitative data only and can conceivably be used for teaching financial analysis concepts as well as providing decision support. FAS consists of four basic components, viz. liquidity, solvency and profitability as well as an administrative component. Standard ratios, such as interest cover, post-settlement gearing and loan security are calculated by the system from current and past financial information. Input to the system can be from the keyboard or from a spreadsheet. FAS prompts the user to supply essential information if a spreadsheet is not available or is incomplete. The system also requires input of administrative details on the loan application. The concepts employed in this ES could be used as input to an ES for agricultural loan evaluation.

Credit Submission Process (CSP)

QIDC, a core element of the entity known as Suncorp/Metway is currently developing a lending support system referred to as the Credit Submission Process (CSP). It will support the lending process by automating the activities involved in loan appraisal. CSP has been designed as a generic system for loan appraisal. However, within CSP, there are specific segments pertaining to rural loans. Financial risk analyses, industry analyses and application of credit standards can be performed using the spreadsheet templates specifically developed for this purpose. The system ensures that all appropriate documentation is completed and no steps in the evaluation process are skipped.

Limitations of these Systems

Many computer-based systems are available specifically to evaluate agricultural loans. Credit scoring tools for agricultural loans have been investigated and reviewed by several researchers [for example, see Turvey 1991 and Chhikara 1989]. While these tools are useful in determining loan-default risk, they form only part of the loan evaluation process. Lenders are using financial analysis systems to efficiently manage a larger and more profitable loan portfolio. As with the commercial systems, the financial analysis systems reviewed tended to focus more on evaluating the financial position of an agricultural borrower using mainly quantitative data. Some qualitative data was included in the form of rules-of-thumb, but still focusing on the client's financial health. Little consideration was given to subjective assessments such as the client's ability to manage the farm and farming business and personal characteristics. Weaknesses can relate to any of the five C's of lending, that is, credit, capital, capacity, collateral and character (Duchessi, *et al*. 1988) and they must be identified as early as possible so banks can minimise the risk of loan default.

While the financial analysis systems described are not strictly loan evaluation expert systems, the knowledge gained in modelling financial management behaviour can lead to an improved understanding of the expertise involved. Any expert system designed to evaluate agricultural loans must be able to perform an evaluation of character. It is probably the most subjective and difficult factor to quantify. Although lenders define character in an ethical or moral sense, it has far greater economic significance (Gustafson 1989). Broadly interpreted, character reflects all the management decisions, attributes and traits that distinguish one farmer's behaviour from another. Stockley (1991) regards the individual management ability of the farmer to be the one of the main contributors to profit variations. The relationship between character variables and financial performance is poorly understood and as such rarely included in a financial evaluation except in some informal sense. Behavioural aspects can directly affect farm prosperity and as such must form part of a lender's evaluation of a borrower's proposal.

AGRICULTURAL LOAN EVALUATION EXPERT SYSTEM

The Agricultural Loan Evaluation Expert System (ALEES) was designed to incorporate qualitative factors such as a loan officer's intuition, experience and judgement as well as quantitative factors. It was developed using an expert system shell (a complete expert system stripped of its specific knowledge). There are three main segments within the ALEES knowledge-base, viz. a) the bank's available resources, b) strategic and policy considerations such as current market conditions and bad debt experience and c) a credit risk assessment based on economic and political conditions as well as a financial and subjective assessment of the borrower. The following sections describes the knowledge acquisition activities, how the knowledge base was developed and validated as well as loan officer perception of the usefulness and effectiveness of the loan evaluation expert system.

Acquisition of Subjective Knowledge

A questionnaire was used in the knowledge acquisition process to elicit the extent loan officers used subjective information during the loan evaluation process (Bryant 1994). Five loan officers from two institutions were asked to complete a questionnaire requesting information on subjective factors they used during the loan evaluation process. The first component requested the relative importance the loan officer placed on qualitative factors. The average response was 6 on a 7-point scale indicating the loan officers regarded qualitative factors as being a very important aspect of loan evaluation. The second component of the questionnaire required the loan officers to weight qualitative and

quantitative factors. The average weight for the qualitative and quantitative factors were 27% and 63% respectively. Each of the factors consisted of a series of sub-factors that were also weighted to indicate their relative importance. The quantitative sub-factor with the highest weight was "Debt Serviceability Ratio" while the "Personal" sub-factor had the highest weight for the qualitative factor.

The third component of the questionnaire required the loan officers to rank the order of importance they placed on the qualitative sub-factors. The order of the rankings were: personal, business, farm stock/crops, family and loan proposal. The individual items were ranked relatively consistently across all loan officers. Descriptions of the qualitative factors were also required. These descriptions were collated and repeated words and ideas were clustered to achieve the favourable, neutral and unfavourable classes to the responses. Two scenarios were used in the final component of the questionnaire to elicit the extent loan offices placed on the qualitative factors. The first scenario considered an "accept loan" situation where quantitative factors were just outside the institution's accepted limits. The other scenario concerned a "reject loan decision" where quantitative factors were within acceptable limits. The first three sub-factors were the same in both scenarios although their order of importance was slightly different. More factors were considered in the "accept" scenario than in the "reject" scenario and again their order of importance was different. The information garnered during the knowledge acquisition process was used in developing the user interface and production rules for the loan evaluation expert system.

Development of the Knowledge Base

Figure 1 shows the dependency diagram for the expert system. It is a complete summary outline of all questions, rule sets, knowledge segments and their inter-relationships, values and recommendations within the system. Rule Set 1 is concerned with making the final decision. Rule Set 2 specifically focuses on the client credit risk assessment that in turn requires evaluation of the Economic conditions (Rule Set 5), the political environment (Rule Set 6) and the client evaluation (Rule Set 3 as well as Rule Set 4 - Subjective Assessment). Other conditions assessed include the Available Resources (Rule Set 7) and the bank's strategic outlook (Rule Set 8). The latter is evaluated by Rule Sets 9 - 12, policy issues, bad debt experience, market conditions and external pressure respectively.

Questions were derived by using the terminology and average weights provided by the loan officers. Rankings provided a relative order of precedence for factor categories and their associated items. A three-point scale was used primarily so loan officers can indicate a negative, neutral or positive attitude toward the item under consideration. Individual categories were combined where necessary in order to measure an officer's overall impressions. Low scores are not regarded as acceptable. Testing of the system with real cases will facilitate the exact cut off point. The rules were then developed using the scores indicated by the loan officers. Rules pertaining to the quantitative factors are contained in the knowledge base along with those associated with the qualitative factors. Because of these rules, the system can then derive an overall result from the individual categories. The system provides the loan officers with the opportunity to reassess the scores for any or all categories before the system makes its recommendation. The recommendation is based on all relevant factors and the information provided by loan officers on individual loan applications. The system was fully verified before undertaking validation (Bryant 1995).

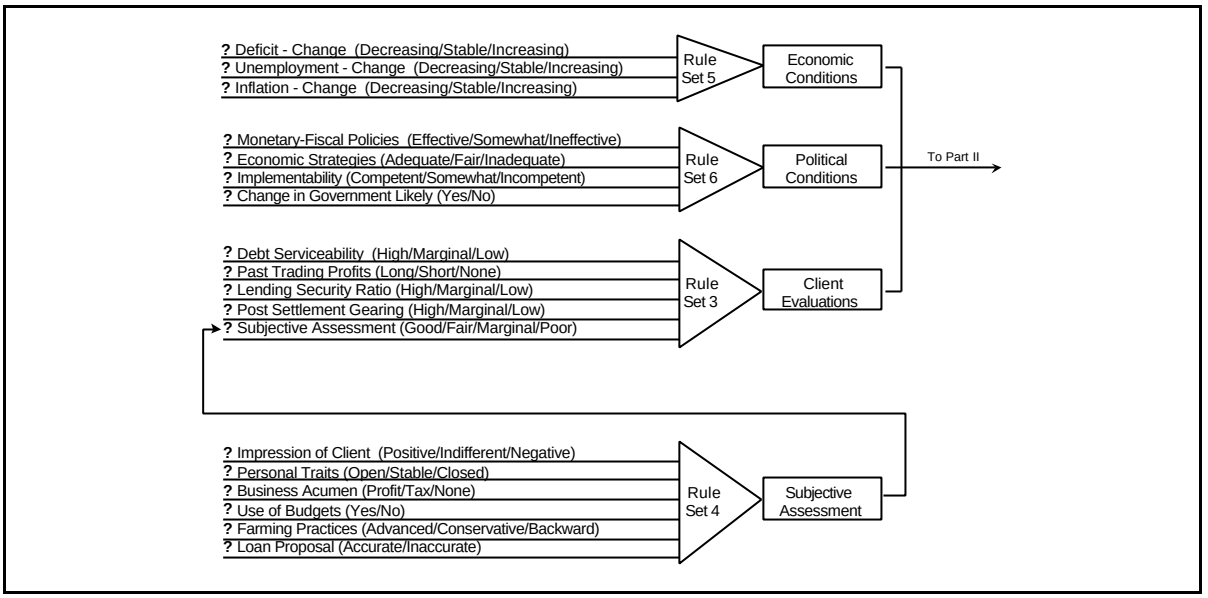

Figure 1: Dependency Diagram – Part 1

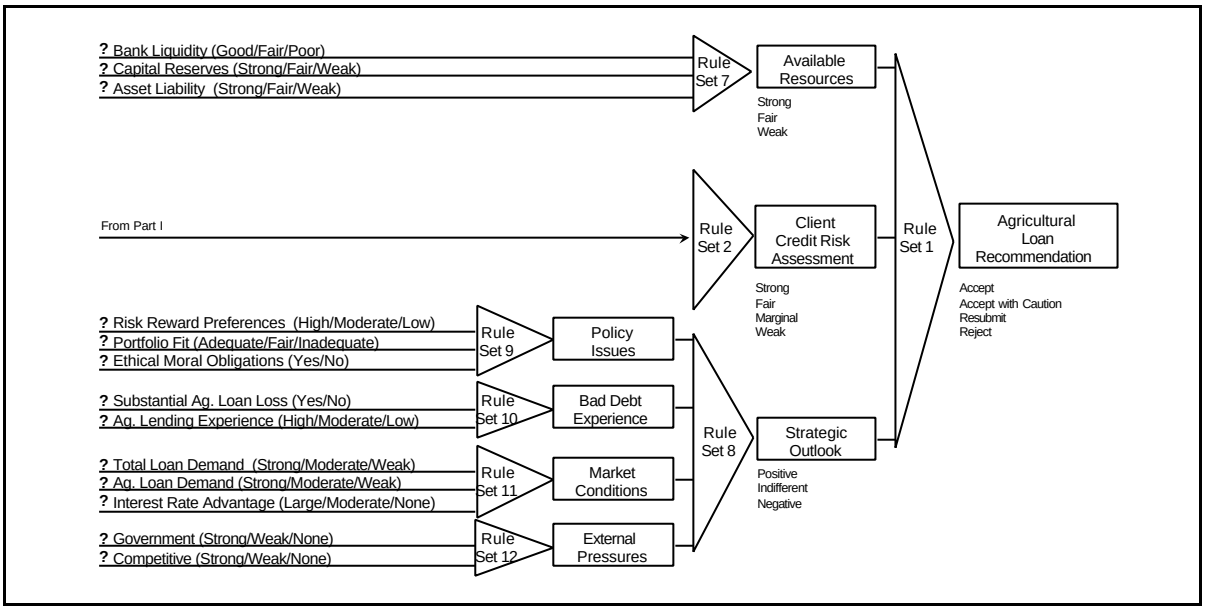

Figure 1: Dependency Diagram – Part 2

ALEES has been designed so that an interface to existing financial analysis packages such as PIBA's Financial Analysis System can be constructed and implemented in the future. This will permit the expert system to retrieve automatically, the necessary quantitative data from a database containing the client's financial information.

Validation of ALEES

Validation of an expert system is an important process in that it checks the accuracy of the inference chains used in the knowledge base to ensure the system provides appropriate and correct results. While O'Leary (1991) identified a number of different methods of validating expert systems, the method selected for validating ALEES was to use both contrived data and actual data. The validation effort was focused on actual data found in the loan-operating environment.

ALEES was validated by comparing its performance in assessing actual loan applications against the evaluations of five loan officers from the two participating institutions (Bryant 1998). Each loan

officer selected several applications including those that were accepted as well as those that were rejected and loan applications from both current and archive files. In all, 45 applications, the size of which ranged from as low as $20,000 to over $1 million, were used to validate the system. All 45 applications were submitted to the system and a 73% success rate was achieved. That is, the system's response matched that of the loan officer in 33 of the 45 cases. After the validation effort, two clients withdrew their loan applications. A review of the 10 mismatched results indicated that client's with a prior history with the financial institution were more likely to have their credit facilities extended. Subsequently, several new rules associated with the new variable called "existing client" were including in the knowledge base. By including the new variable, 9 out of 10 mismatches were accepted resulting in 97.6% success rate. The next step in the development of ALEES is to evaluate user acceptance.

Loan Officer Acceptance and View of ALEES

Before an expert system can be considered complete, it must be shown that users regard it as being useful and will accept and use it in their work environment (Durkin 1994). This section documents loan officer perceptions of ALEES and its usefulness in loan evaluation. On concluding their validation session, the five loan officers who participated in validating ALEES were asked to complete a questionnaire for this purpose. The questionnaire contained three sections. Section A consists of 16 questions: eight on personal characteristics of the loan officers; four of their computing skills and a further four on the expert system and its usefulness. Section B contains 10 questions pertaining to the perceptions of the loan officers of the expert system and their experience with it. Section C includes four open-ended questions where loan officers could write comments on the system's relative strengths and weaknesses, suggest ways in which the system could be improved and offer any other relevant comments on the system.

A cross comparison of the questions in Section A with those in Section B revealed some interesting facts. Although the loan officers in general regarded their computing skills to be below average they all agreed the system was easy to learn, use and most liked working with computers. Four of the five loan officers were eager to use the system while one was hesitant. However, all would use the expert system again to help them during loan evaluation activities. Four loan officers preferred to use the expert system to manual methods. It is interesting to note that the loan officer who was the oldest and with the longest work experience in loan evaluation, preferred not to use computers. However, this observation should not be construed as meaning more mature loan officers do not like to use computers as two other loan officers in the same age group do like to use computers for their work.

The only loan officer who regarded the system as being able to help in learning more about her decision making process, was the least experienced in loan evaluation, that is one year. The other loan officers had at least three years loan evaluation experience (average = 7 years) and their responses ranged from 1 to 4 on the 7-point scale. While the system may not have helped most of the loan officers to learn more about their decision making process, all but one loan officer agreed the expert system helped them clarify their thoughts. While this loan officer's response to the question was three, he was still satisfied with the system (response = 5) notwithstanding his preference to avoid using computers whenever possible.

All of the loan officers regarded the expert system as being useful. However, their opinions were divided over whether or not the system provided useful information. The loan officer who provided the highest response (= 6), had the shortest loan evaluation experience (one year). Conversely, the loan officer who had used the rural credit rating scoresheet provided the lowest rating on this

question. His loan evaluation experience was 10 years. It would seem his expectation of the information provided by the expert system was coloured by his long use of the manual scoresheet approach. It is interesting to note that he, along with all the other loan officers, regarded the effectiveness of the expert system highly. Further, he was very satisfied overall with the expert system. The only loan officer who was not entirely satisfied with the expert system was also hesitant about using it. However, this loan officer still regarded the system as being useful and effective. He neither agreed nor disagreed (response = 4) that the system provided useful information.

The responses to the open-ended questions in Section C provided some further insights. The loan officers agreed that the expert system's strengths lay in its ease of use, its clarification of the loan officer's thoughts and the speed in which it provided a recommendation. There was no consensus on the system's weaknesses. Responses included its terminology and explanations of the recommendation, its mechanistic nature, its failure to analyse loans more closely and its lack of an industry section. These weaknesses correlated closely to suggested improvements to the system.

CONCLUSION

The banking industry in Australia is facing a time of fierce competition and lower profit margins, mostly due to the effects of deregulation and the increase in the number of institutions able to provide credit facilities. Despite the economic disasters of the 1980s, banks are still keen to lend money as lending is after all, part of their business. However, for their client's and shareholder's sake, they are careful to be fully informed when conducting that business. These evaluations are still based on the lender's knowledge and analyses of an individual's or firm's ability to service a debt, the equity the borrower has and the borrower's credit history in meeting financial commitments. This should be equally true for borrowers. Lenders also need to take into consideration the economic climate in which the business is operating, the likely influence it has on cashflows and on what is a prudent equity position. Monitoring the creditworthiness of farmers involves tracing these trends, shifts and adjustments that affect the operating environments of both lenders and borrowers.

New strategies such as expert systems are required to lower operating costs and increase productivity as well as profits. This paper provides evidence of loan officers' acceptance of and perception of the usefulness and value of the expert system that incorporates qualitative judgements into the lending decision. All of the loan officers regarded the expert system highly, that is, as being useful and effective. They were also well satisfied with it. Only one loan officer was hesitant about using the system. All of the loan officers considered the system as being easy to learn and use although they regarded the terminology used by the system, especially in two questions, needed clarification. All loan officers believed the system helped them clarify their thoughts while only one considered the system helped her learn more about her decision making process. While the majority of loan officers would prefer to use technology again, one did not. However, while this same loan officer preferred not to use computers at all, it was intriguing to note that he would use ALEES again.

The overall response to the system appears highly positive. It is apparent the loan officers consider the system as a useful tool for evaluating agricultural loan applications and to help in clarifying their thoughts. This finding has particular relevance for the less experienced loan officers who found the expert system most useful. It would suggest the expert system could play a strong role in assisting inexperienced or junior loan officers with the loan evaluation process and in the provision a training mechanism for loan officers.

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