Procedure for Developing Financial Analysis Expert Systems

The financial adjustments taking place in agriculture have clearly demonstrated the need for better informed financial decisions by farmers, ranchers and agricultural lenders. Accounting systems, financial statements and investment analysis tools are important for financial analysis. These tools support decision making, however, their usefulness is limited due to the knowledge required to interpret the information generated and the lack of prescriptive guidelines to use in an analysis.

The purpose of this software development effort is to enhance financial management through more effective use of accounting and financial statement data by farmers, ranchers and lenders. The development effort helps identify the critical factors to consider in financial analysis. Expert system technology is used to incorporate a knowledge base composed of facts and rules into the software. This addition to the software increases the diagnostic and interpretive power for users.

This paper briefly describes the expert system development effort and a prototype in the testing stage of development.

Procedure

The following steps are being followed in developing the Texas financial analysis expert system:

1. Problem formulation and learning about technology.
2. Target audience identification.
3. Support proposal development.
4. Interaction with lender expertise, target audiences and review of literature.
5. Define structure, components and criteria.
6. Prototype development.
7. Field testing and revision.
8. Productizing and marketing.
9. Maintenance and enhancement.

Target Audience and Participants

The expert systems are intended for a broad audience of users. The target audience includes farmers and ranchers, the Farm Credit System, commercial banks, and educators. In the development, specific needs of different audiences were identified. Representatives from each target group were requested to participate in expert knowledge preparation and in field testing.

Given the target audience, it is important that the Agricultural Financial

---
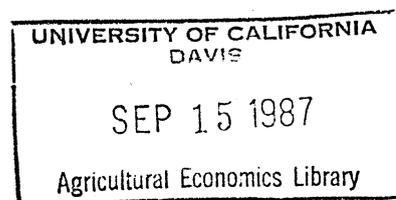
Analysis Expert System (AFAES) operate on MS-DOS based microcomputer systems. Although potentially restrictive in terms of the speed and size of the programs that can be run, one can expect a much greater use of AFAES if it is aimed at these microcomputers. Over time with growth in microcomputer memory capacity, speed, and improved expert system software, the capability of the AFAES can be enhanced.

Participants

The project is being implemented by the Texas Agricultural Experiment Station and Texas Agricultural Extension Service. Research, extension and technology staff are involved in the design, review and testing. The other participants are described below.

Farm Credit System

The largest single lender in agriculture is the Farm Credit System (FCS). The Farm Credit Banks of Texas have approximately 55,000 borrowers and 4 billion dollars in agriculture loans. The FCS is participating in development and testing of the expert systems for agriculture finance. This participation involves a recently retired chief executive officer, Mr. James Rodgers, of the Farm Credit Bank of Texas. Production Credit Association directors and loan officers located in four production regions of Texas (Tyler, El Campo, Plainview, and Stephenville) are also involved. The FCS is primarily providing staff support (lending officers and top administrators who formulate lending policy).

Software Vendors

Several of the national leading agricultural software vendors were contacted to solicit their participation in interfacing the AFAES into their farm and ranch accounting and financial analysis software. These vendors also were asked to provide assistance in testing and evaluation of AFAES. The firms that have offered their assistance include: Red Wing Business Systems, Inc., Farm Business Systems (FBS), Datasphere, Control Data Corporation, Agricultural Products and Services Division, and Agro Systems Corporation. These firms account for a large portion of national software sales. Their participation provides opportunities for a broad testing of the AFAES, and help with interfacing the expert systems into a number of accounting and financial analysis software systems widely used in agriculture. These firms will also facilitate marketing the products of this effort.

Producers

In the past five years, the Department of Agricultural Economics at Texas A&M University has had an active microcomputer software development effort. A group of farmers and ranchers have helped test and evaluate the software. This same group will participate in evaluation of AFAES.

Private Lenders

Initially, the development effort is aimed at FCS participation. Other private lenders have been approached for testing and evaluation. Response has been positive not only for interest in the analytical tool, but also for loan documentation requirements and procedures.

Other University Participation

Efforts are being made to acquire funding to involve a number of university and lending professionals in the project. The goal is to coordinate this activity with other work in agricultural financial management on a regional and national level.

Questions Addressed by the Expert System

After initial interviews with lending specialists, the following agricultural financial analysis questions were decided as the most important to address:

1. What is the financial condition of the farm or ranch business?

2. Can the farm or ranch business support the present operating loan commitments or additional operating capital requested?

3. Can the farm or ranch business support the present operation and term loan commitments or the additional term loan requested?

4. Can the financial condition of the farm or ranch business be improved by restructuring debt?

The diagnostic tool is intended for use when outstanding loans or requests are greater than $100,000 and are supported primarily from agricultural earnings. The borrower must provide at least three years of balance sheets and income statements verified by income tax information.

Output provided by AFAES is a graphic presentation based on a favorable or unfavorable scale. An explanation of how the expert system reached its conclusion is displayed and printed for each solution. This type of output will enhance the user's judgement and decision making.

Prototype ES's are being developed, moving from simple to more complex systems, by adding rules, expert knowledge, testing, and verification in the user decision environment.

Brief Description of AFAES

Figure 1 illustrates the major components of the financial analysis expert system. A set of Lotus and coded programs help the user assemble the necessary data. Considerable flexibility exists to interface the data generated from other software, particularly accounting or financial analysis programs which generate financial statements. A regression analysis program calculates trends. Graphic display of data will exist at this level of the system.

In the lender standards section, lenders will enter standards specific to their institution. These standards are checked to provide information to the lender. The standards range from yes or no responses about loan documentation to specific qualifications in terms of ratios or collateral guidelines. The standards are set up independently and do not interact directly with the expert system analysis.

3

```
┌─────────────────────────────────────────┐
│                 USER                    │
└─────────────────────────────────────────┘
        │            ↕              ↕
        │     ┌──────────┐   ┌──────────────┐
        │     │  LOTUS   │   │ OTHER PRGMS  │
        │     └──────────┘   └──────────────┘
        │           │              │
        │     ┌─────────────────────────┐
        │     │    DATA FOR ANALYSIS    │
        │     └─────────────────────────┘
        │          ╱              ╲
        ↓         ↙                ↘
┌──────────────────┐      ┌──────────────────┐
│     LENDER       │      │  FIN.ANALYSIS    │
│   STANDARDS      │      │   EXPERT         │
│ INPUT & CHECK    │      │   SYSTEM         │
└──────────────────┘      └──────────────────┘
        │                          │
        ↓                          ↓
┌──────────────────┐      ┌──────────────────┐
│    RESULTS       │      │   RESULTS        │
│                  │      │   OF E.S.        │
│   OF CHECK       │      │ U      N      F  │
│                  │      │ ┌────────┬─────┐ │
└──────────────────┘      └──────────────────┘
        │                          │
        ↓                          ↓
┌─────────────────────────────────────────┐
│         INFORMATION FOR USER            │
└─────────────────────────────────────────┘
```
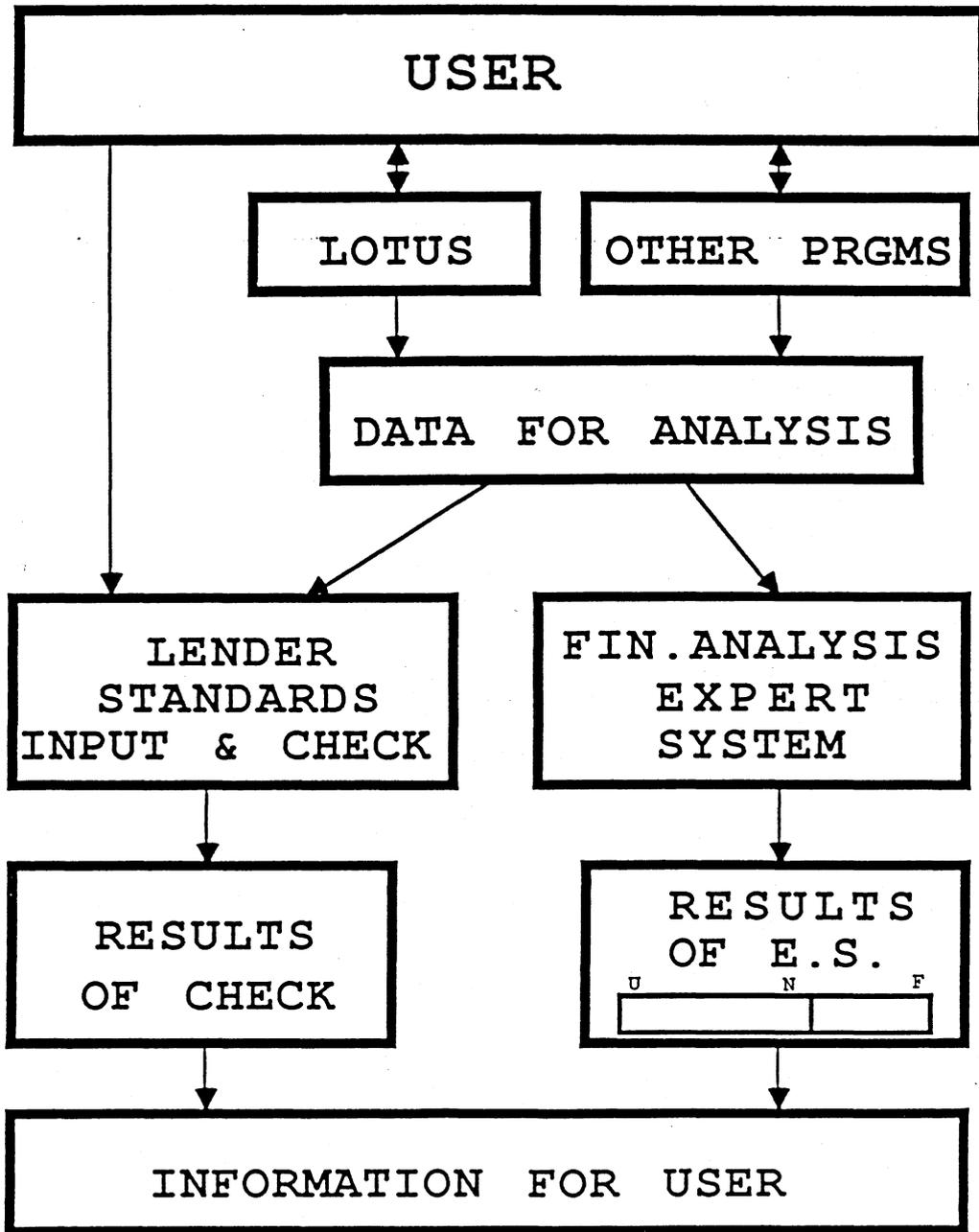
Figure 1. Components of the Agriculture
            Financial Analysis Expert System

The AFAES evaluates the four questions in the expert system component. The knowledge base for the diagnostic analysis is incorporated in this section. The result of the diagnostic analysis is presented in graphic form on an unfavorable to favorable scale. Rules used and their associated weights are displayed or printed with the actual data used in the analysis. Results are shown in graphic form as illustrated in Figure 2. Information is presented in this way to indicate to the user not only the results of the analysis, but also to reinforce the limitations of the diagnostic tool in terms of the final decision. As indicated in the scope of the tool, the decision maker must address the important aspects of the borrower's character, risk and other factors not considered in the analysis.

Question 4 addresses the effects of change in debt structure on financial condition. Capability to do simulations of different situations followed by financial condition evaluation will be a feature of this diagnostic tool.

Criteria in the Diagnostic Analysis

A large number of private and public sector accounting and financial analysis tools and research literature have been reviewed to identify criteria, analysis rules and documentation procedure. Two general observations can be made. First, the analysis and diagnostic aspect of many existing tools has been neglected and seems to be secondary to data and information generation. Second, analysis criteria is very inconsistent; many times it contains highly correlated ratios and trends for analysis. Most software and manual financial analysis forms and tools do not address collateral issues. With the exception of scoring models, limited efforts have been focused on defining the relative importance of different factors for analysis. All this leads to an opportunity to sort out relevant criteria for analysis and test this criteria in the lending, borrowing and financial management activity.

Figure 3 illustrates the major criteria considered for the prototype addressing the financial condition of the firm. The overall financial condition is a function of each criteria and the weight given to the criteria for the question addressed. For example, the liquidity of the firm is evaluated with a specific measure (current ratio). This evaluation is combined with the relative weight liquidity is given. The overall conclusion is reached after considering each factor and weight combined.

Potential Benefits

Potential benefits from this project include:

1. Improved documentation and financial analysis in agriculture which can lead to improved lending and borrowing practices and financial management.

2. Improved communication between software developers, lenders, borrowers and educators through more standard loan documentation and analysis procedures.

3. More effective use of financial information generated by manual and computerized farm and ranch accounting systems.
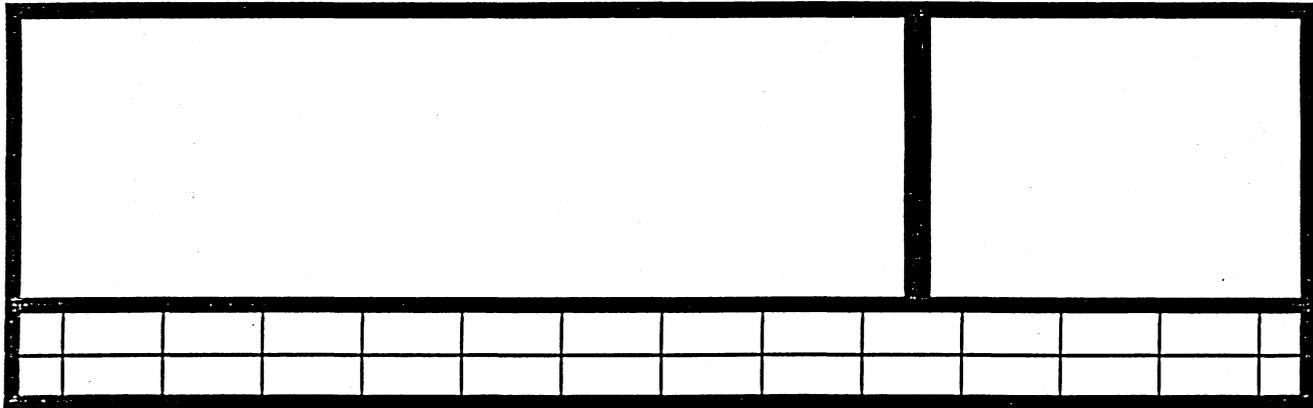
Figure 2.

FINANCIAL CONDITION

GRAPHIC DISPLAY

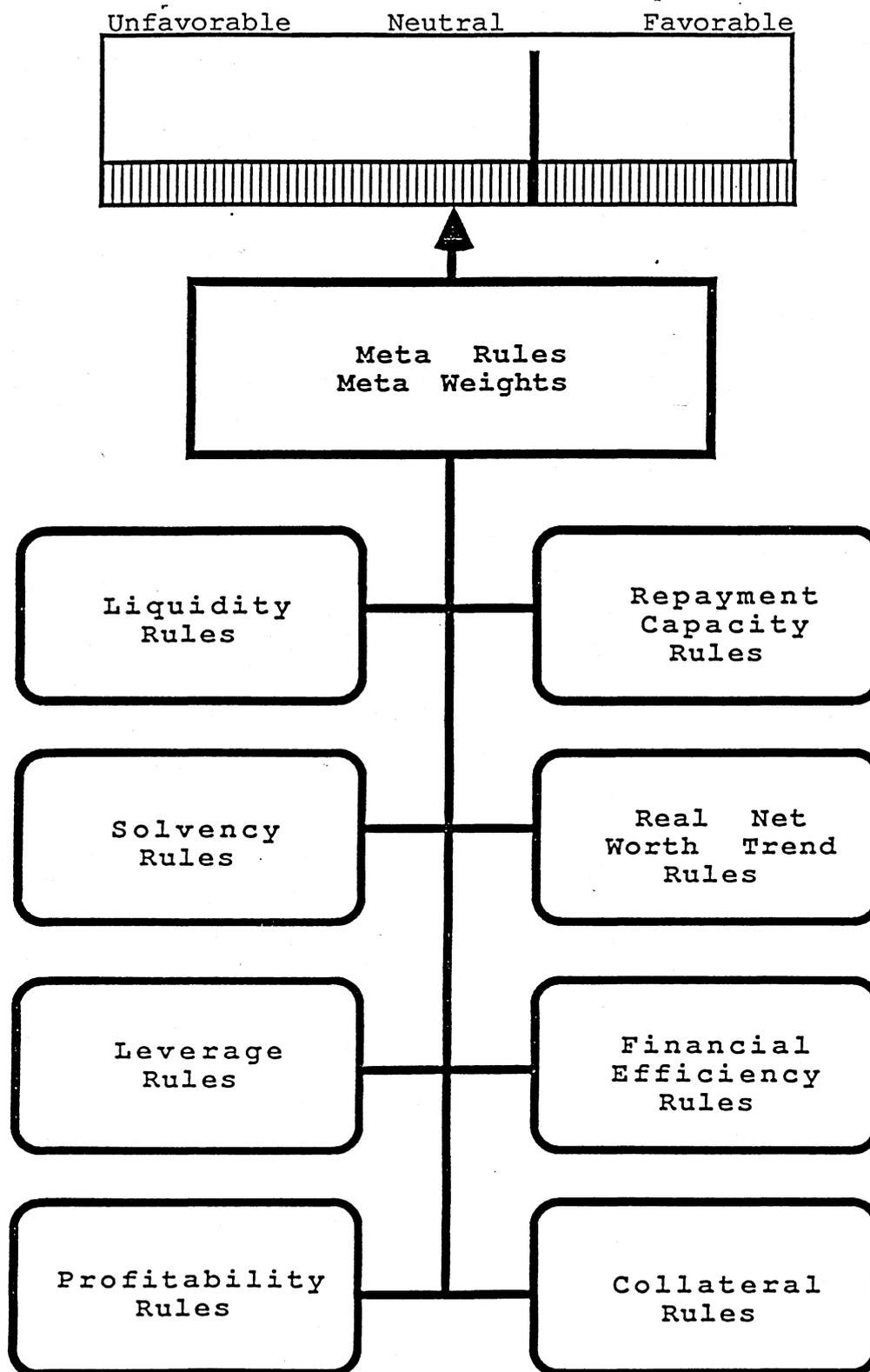UNFAVORABLE   NEUTRAL   FAVORABLE

EXPLANATION

- Rules used in the analysis
- Unfavorable or favorable status
  and weighting factor used

Figure 3.

FINANCIAL CONDITION

Unfavorable   Neutral   Favorable

Meta   Rules
Meta Weights

Liquidity Rules	Repayment Capacity Rules
Solvency Rules	Real Net Worth Trend Rules
Leverage Rules	Financial Efficiency Rules
Profitability Rules	Collateral Rules

4.   Improved education programs for students, loan officers and producers.

Observations and Summary

The opportunity to add a knowledge base to software significantly improves the effectiveness of microcomputer use in agriculture. The target audience frequently lacks the educational background to utilize information generated by present software. Most agriculture software could be enhanced with an addition of rule based expert system technology.

Development of expert systems is extremely costly in terms of human time to develop and test the rule base. Verification is extremely important because of a greater reliance on the product's diagnostic power by the user.

Maintenance, enhancement and marketing of expert systems is going to be a major road block for land grant institutions. It will require a closer working relationship with the private sector for marketing and long-term support.

A critical issue in American agricultural finance today is not generation of new information and knowledge, but finding ways to more efficiently deliver available information, knowledge and analytical tools. Expert systems technology offers a tremendous opportunity to help overcome the problem of inadequate financial analysis in agriculture.