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Implementation of Expert System for Lending With Certainty Factor

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ABSTRACT : *Economic activities and investments require resources and capital. Developing countries are faced with limited resource; therefore the need to select proper projects is intensified. Our country is not an exception to this rule, where lack of adequate resource allocation and planning has caused many projects to come to a standstill. This paper reports on the implementation of an expert system, which takes advantage of expertise in the area of granting loans to build a knowledge base. The system helps in making evaluations and expediting activities. Furthermore, using this system, accuracy is improved, allowing managers to trust expert decisions in granting or rejecting loan requests with more confidence. The proposed system uses a certainty factor to determine the characteristics of the case and ultimately help managers make better decisions.*

KEYWORDS: *expert system, knowledge base, certainty factor, loan*

I. INTRODUCTION

In the modern world, especially in developing countries, large investments are made to facilitate economic growth. Making investments requires financial resources, which are often controlled by banks and provided for projects in form of loans. Identifying profitable projects is an important issue. Moreover, the significance of rejecting or accepting loan requests in developing countries, including Iran, is known to everyone. If clear rules, based on science, are used in evaluating plans and allocating resources, projects will not remain unfinished nor become economically unjustifiable. This paper aims to assist banks decide whether to accept or reject a particular loan request. Using the C Language Integrated Production System (CLIPS), we have tried to build an expert system, to help increase accuracy and speed in evaluating loan requests. Although senior management makes the ultimate decision, he does so based on experts' opinions. There is a lack of such expert systems in our baking industry. Previous works in this area have not considered a certainty factor. This factor gives managers a percentage of certainty to base their decisions on. Moreover, fuzzy logic can further enhance the system.

II. OVERVIEW OF THE SOFTWARE

When deciding on a loan request, various factors are taken into account. Senior managers, as the ultimate decision makers, consider the following factors[1].

1- Expert evaluations (economic analysis):

[1] Physical infrastructure
[2] Using modern technologies.
[3] Resources.
[4] Certification.
[5] Market demand.
[6] Product innovation.
[7] Market competition.
[8] Similar previous projects.
[9] Exportability.

2- Senior management's assessment (technical feasibility):

[1] Employees' knowledge and skills.
[2] Manager's capabilities.
[3] Sales system.
[4] Stakeholders' credit status.

3- Justification plan (Economic analysis):

[1] Economic evaluation.
[2] Collateral quality.
[3] Five-year performance.
[4] Net present value.
[5] Liquidity.
[6] Current ratio.
[7] Cost.

4- Manager's trustworthiness and loan history.

5- Available resources and the bank's strategies (variable among banks).

Each of the mentioned factors can be evaluated on a qualitative scale (poor, average, good, and excellent). However, such a scale is not appropriate, since individuals can interpret each degree differently. A certainty factor can help eliminate such misinterpretations, making decisions more reliable. Table I: shows the rating scale for the study[1].

Table I: Rating Scale

Evaluation result: obtaining a minimum score from the expert system (on a scale of 1 to 5)	**Poor**	**Weak**	**Average**	**Good**	**Excellent**	**Evaluation (EV)**
	1	2	3	4	5	Grant rate based on surveys and interviews of experts

The minimum score requirements of the system for request grant/rejection, based on expert knowledge and previous studies, are shown in Table Π.

Table Π: Minimum grant scores

Factor	***Number of subcomponents***									
Expert evaluation	1	2	3	4	5	6	7	8	9	
Minimum score for request grant for each component	4	3	4	4	4	3	3	3	3	Minimum score = 31
Justification plan	1	2	3	4	5	6	7			
Minimum score for request grant for each component	5	3	4	3	2	3	3			Minimum score = 23
Senior management's assessment	1		2		3		4			
Minimum score for request grant for each component	3		5		4		3			Minimum score = 15

In this manner, minimum scores and the certainty factor can help in evaluating a project and ultimately deciding on the loan request. Since the certainty factor is expressed in terms of factors, it will streamline the decision making process. Each of the four considered factors has certain dependencies. For instance, project feasibility depends on four other factors. These factors are assigned degrees of certainty based on questions answered by the user. The degrees are either directly assigned by the user or determined from his answers. Using all factors and questions, an overall degree of certainty for each of the four factor is determined. After determining the certainty of each factor, we have the following rule[2,3].

(management disagreement) (Edesign fair)(trust poor)(Evaluation good)

➔

(printout t "your loan request Reject")

The rule has an overall Certainty Factor (CF), which is obtained from previous records of the bank. In order to determine the certainty of rejection, minimum CFs are multiplied by the overall CF.

CF (loan request Rejected) = min ($CF_{management\ disagreement}$, $CF_{Edesign\ fair}$, $CF_{trust\ poor}$, $CF_{Evaluation\ good}$) * CF_{overall}

The determined percentage is then used to express the certainty associated with rejecting a request.

In order to make a final decision, we need to have some rules and relations between the factors, which are provided by experts. The tree in Figure (2) classifies the rules, so that they can be more easily understood.

III. MECHANISMS

The system is written using the CLIPS programming language. In the first step, the user is given several questions to answer. The final result is expressed using a certainty factor. Unlike previous works which rate requests as poor, average, or excellent, the proposed system provide a numerical basis for evaluations.

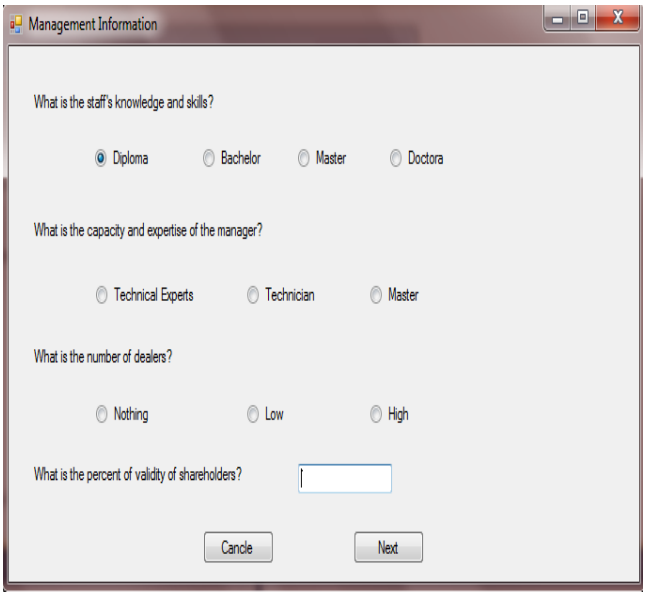

Figure 1: Receiving management's information

IV. TECHNICAL SPECIFICATIONS

The proposed system is a rule-based expert system with forward-chaining. All necessary facts, i.e. information about certainty factors, are obtained from the user interface. Using rule matching the facts are, then, matched with the rules in the knowledge base. Finally, the rules are used to make a decision about the request[3,4].

Factors used in evaluation are as follows:

[1] Edesign: justification plan.
[2] Management: senior management's assessment
[3] Evaluation: evaluation by experts.
[4] Trust: the manager's trustworthiness and loan history.

```
(defrule MAIN::rule1
  (decision (management disagreement)(evaluation fair))
=>
  (printout t "Your Loan Request Rejected"))
 (defrule MAIN::rule2
  (decision (management disagreement)(edesign fair)(trust poor))
=>
   (printout t "Your Loan Request Rejected"))
(defrule MAIN::rule3
   (decision (management disagreement)(edesign fair)(trust poor)(evaluation good))
=>
   (printout t "Your Loan Request Rejected"))
```

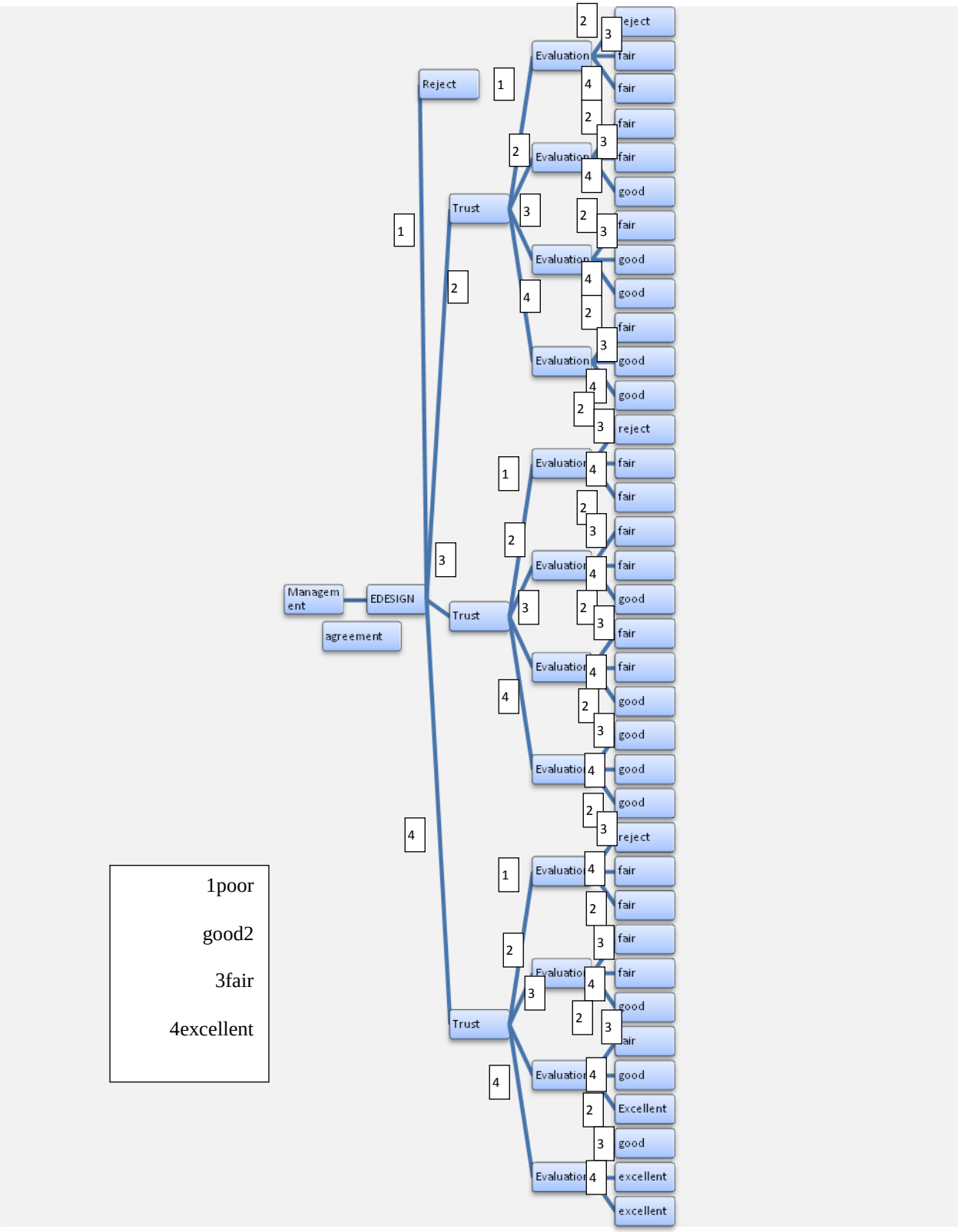

Figure 2: Tree of conclusion

```
(defrule MAIN::rule4
        (decision (management disagreement)(edesign fair)(trust fair)(evaluation excellent))
=>
        (printout t "Your Loan Request is fair"))
(defrule MAIN::rule5
        (decision (management disagreement)(edesign fair)(trust good)(evaluation good))
```

```
=>
        (printout t "Your Loan Request is fair"))
```

V. CONCLUSION

Expert systems are very common in developed countries. Such systems are very important in evaluating projects. More accurate and unbiased evaluations will lead to a higher rate of project completion.
In developing countries, especially Iran, limited resources force investors to evaluate projects before accepting to provide money. However, despite this fact, many projects remain unfinished, which shows the need for further studies in this area. Intelligent and expert systems can greatly improve the quality of decisions and improve performance. In this paper, an expert system was implemented which helped banks decide whether or not to grant a loan request. The proposed system can be improved using fuzzy logic.

REFERENCES

[1] N Cai, L Sun, ”Valuation of stock loans with jump risk”, Journal of Economic Dynamics and Control,Volume 40, March 2014, Pages 213–241
[2] Y Demyanyk,I Hasan,”Financial crises and bank failures: a review of prediction methods” , 2010 – Elsevier
[3] MG Yunusoglu, H Selim “A fuzzy rule based expert system for stock evaluation and portfolio construction: An application to Istanbul Stock Exchange”, 2013 – Elsevier
[4] J Bessis ,“Risk management in banking”,2011