

# The Effect of Expert Systems Application on Increasing Profitability and Achieving Competitive Advantage

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## **Abstract**

This study investigated the development of a knowledge base for expert system for assessment of bank's legal customers. It analyzed the customers' credit risk based on experts' financial ratio analysis. Financial ratios were derived from financial statements of customers; however, the knowledge that helps banking experts to determine the relationship between customers' credit risk and financial situation has been derived from these laws. In this study, expert system considered customer financial ratios as input and prediction of credit risk level as the output. This study was a descriptive-case study research. The population consisted of credit experts of Tejarat bank who were the member of bank's credit Committee and had the right to vote for facilities approval and the individuals whose main task was providing reports for granting facilities and monitoring the use of facilities. After an initial interview and determining the evaluation criteria for facilities and determining the items for each of the criteria, a questionnaire was designed using Likert scale. Data normality test was conducted to ensure the accuracy of the collected data. T-test was performed to realize the selected criteria are important. Then, experts were asked to determine the minimum score for providing the facility to the applicant in each section of the questionnaire. The laws of expert system were provided based on determined minimum scores.

**Keywords:** Risk Management, Credit Risk, Expert System

## **Introduction**

Based on the information reported by credit agencies, banks and credit card companies, credit rating primarily assesses the loan potential risk to minimize the risk of not refunding the loan. Lenders can use credit ratings in order to determine who is eligible to what sources of loan and to what interest rate. In the general perspective, the credit ratings of previous customers -both loyal and defaulting customers-is used to find the relationship between credit ratings and the set of evaluation criteria.

Following a good model for the evaluation of new applicants is an important element in achieving this goal. In the credit rating, the process is composed of two procedures: 1) to apply quantitative techniques to previous customers - both loyal and defaulting customers- to explore the relationship between credit ratings and the set of criteria, 2) using the discovered relationship between credit ratings of existing applicants and evaluating the new applicants as good or bad (Yu,2009).

There are different models for credit rating. Banks and organizations involved in granting credits use one of the models based on their circumstances and the surrounding communities. In this section, we will first give a brief introduction of the most popular credit ratings models.

Based on the theories and methods, credit ratings models can be divided into two main groups [Gorbani & Tajali, 2005]:

A - Parametric credit ratings models:

Linear Probability Model

Probit and Logit Models

Discrimination Analysis- Based Models

B – Nonparametric credit ratings models:

Mathematical Programming

Classification Trees(Recursive Partitioning Algorithms )

Nearest Neighbours Model

Analytical Hierachy Process

Expert Systems

Artificial Neural Networks

Evaluating the validity of a company is a complex process that requires the analysis of financial and economic indicators such as:

1. Income and cost structure indicators

2. Business performance indicators

3. Business profitability indicators

4. Payment of debts indicators

5. Supplementary indicators (lever)

6. Credit ratings has both financial and non-financial aspects. However, this study is limited to evaluate the financial performance of bank Customers.( Pourdarab,etal.,2011)

7. Potential benefits of credit ratings

8. Reducing Costs

9. Systematic evaluation systems such as credit rating reduce the role of human (impact of human error) in the evaluation and thus potentially reduce the risk and cost of granting credit.

10. More accurate prediction

11. Along with improved rating systems, these systems will be more effective in predicting the actual performance of loans

12. Better products and marketing

13. Due to the shorter process of granting loans, customers will attract and the demand for credit will be increased.
14. General benefits of the rating system for banks and their customers can be summarized as follows:
  15. For customers
  16. Easier borrowing process
  17. Response in a shorter time
  18. Reduction of required information
  19. Faster and easier access to credit when customers need it.
  20. For banks
  21. Reduction of loan assessment costs
22. Standard granting of loans in all banks
23. Increasing of loan granting efficiency allow the banks to carry out the loan granting process with more efficiency-due to the repeatability
24. Disadvantages of the system
25. Lower availability and attention to some aspects of lending
26. Applicants of loans with limited credit histories may be unable to obtain loans
27. Level of privacy
28. Rating systems with the customer database may increase the likelihood of violence to customer information
29. Lack of flexibility
30. Due to the use of past data and the lack of such historical changes, rating systems are not flexible enough in dealing with future shocks and structural changes
31. The results of a study showed that almost 20 percent of individuals who was granted based on traditional methods were granted in the credit rating methods, too. While, 20 percent of other individuals who was not granted based on traditional methods were granted in the credit rating methods(21).

### **Methodology**

The present study is a fundamental research; because it aimed to explain the relationship between consumer credit and credit risk and add to the collective knowledge in this area. The study is a descriptive study; and Since the researcher wants to observe special aspects and interpret all aspects from holistic perspective, it is a case study. The population was consisted of credit experts of Tejarat bank who were the member of bank's credit Committee and had the right to vote for facilities approval and the individuals who their main task was providing reports for granting facilities and monitoring the use of facilities (N=25). 25 questionnaires were sent to reflect the opinions of the individuals; 19 cases completed the questionnaires. The demographic characteristic of questionnaires were analyzed using descriptive statistics including frequency tables, percentages and drawing diagrams.

After encoding the questionnaires and computing the descriptive indicators, Shapiro test and the Kolmogorov - Smirnov test (for ensuring the accuracy of the results) and T-test -using SPSS software- was used for statistical hypothesis testing and generalization of the results to the research community.

**Findings**

Prioritizing companies or institutions from the lowest risk

Priority order (from lowest risk)	Average (Score from 1-5)	total score (Score from 1-95)
1. Public stock	1.95	37
2. Joint Stock	2.37	45
3. Partnership	2.63	50
4. Cooperative	3.11	59
5. Limited liability	4.32	82

**T test results**

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Public stock	7.869	18	0.000	1.947	1.43	2.47
Joint Stock	13.568	18	0.000	2.368	2.00	2.74
Partnership	7.143	18	0.000	2.632	1.86	3.41
Limited liability	22.940	18	0.000	4.316	3.92	4.71
Cooperative	12.302	18	0.000	3.105	2.57	3.64
2 personality	9.848	18	0.000	1.316	1.04	1.60
personality 3	13.568	18	0.000	1.579	1.33	1.82
personality 4	16.734	18	0.000	1.737	1.52	1.95
personality 5	10.875	18	0.000	1.526	1.23	1.82

economy 1	7.839	18	0.000	1.368	1.00	1.74
economy 2	10.500	18	0.000	1.474	1.18	1.77
economy 3	12.010	18	0.000	1.316	1.09	1.56
economy 4	6.050	18	0.000	1.158	0.76	1.56
economy 5	5.339	18	0.000	1.000	0.61	1.39
economy 6	5.267	18	0.000	1.158	0.70	1.62
Commercial1	11.339	18	0.000	1.579	1.29	1.87
Commercial2	10.500	18	0.000	1.474	1.18	1.77
Commercial3	14.350	18	0.000	1.632	1.39	1.87
Commercial4	10.875	18	0.000	1.526	1.23	1.82
Commercial5	8.547	18	0.000	1.316	0.99	1.64
Commercial6	2.970	18	0.008	0.526	15	0.90
Commercial7	9.549	18	0.000	1.526	1.19	1.86
Production1	13.568	18	0.000	1.579	1.33	1.82
Production2	9.848	18	0.000	1.316	1.04	1.60
Production3	7.655	18	0.000	1.316	0.95	1.68
Production4	6.600	18	0.000	1.158	0.79	1.53
Production5	7.655	18	0.000	1.316	0.95	1.68
Production6	4.916	18	0.000	0.737	0.42	1.05
Production7	5.953	18	0.000	1.105	0.72	1.50
Production8	6.315	18	0.000	1.263	0.84	1.68
Production9	14.350	18	0.000	1.632	1.39	1.87
Production10	10.500	18	0.000	1.474	1.18	1.77
Service 1	6.994	18	0.000	1.316	0.92	1.71

Service 2	6.533	18	0.000	1.105	0.75	1.46
Service 3	9.848	18	0.000	1.316	1.04	1.60
Service 4	12.036	18	0.000	1.368	1.13	1.61
Service 5	6.647	18	0.000.	0.947	0.65.	1.25
Service 6	6.050	18	0.000	1.158	0.76	1.56
Service 7	10.500	18	0.000	1.474	1.18	1.77
Service 8	6.508	18	0.000	1.053	0.71	1.39
Service 9	7.394	18	0.000	1.421	1.02	1.82
Service 10	7.550	18	0.000	1.000	0.72	1.28

The minimum score for acceptance of any of the facilities

The applicant's personality and credit competency	$7 \leq x < 10$	Excellent
	$5 \leq x < 7$	Good
	$0 \leq x < 5$	Average
	$-5 \leq x < 0$	Bad
	$-10 \leq x < -5$	Very bad
Economic analysis (descriptive or qualitative study of activity)	$6 \leq x < 12$	Excellent
	$4 \leq x < 6$	Good
	$0 \leq x < 4$	Average
	$-6 \leq x < 0$	Bad
	$-12 \leq x < -6$	Very bad
Technical and operational analysis of activity (business activities)	$10 < x < 14$	Excellent
	$5 < x < 10$	Good
	$0 < x < 5$	Average
	$-7 < x < 0$	Bad
	$-14 < x < -7$	Very bad
Technical and operational analysis of activity (production activities)	$12 \leq x < 20$	Excellent
	$7 \leq x < 12$	Good
	$0 \leq x < 7$	Average
	$-10 \leq x < 0$	Bad
	$-20 \leq x < -10$	Very bad
Technical and operational analysis of activity (service activities)	$7 \leq x < 14$	Excellent
	$5 \leq x < 7$	Good
	$0 \leq x < 5$	Average

	$-7 \leq x < 0$	Bad
	$-14 \leq x < -7$	Very bad

**Discussion, Conclusions, limitations and recommendations**

Credit rating is a technique helps some organizations, such as commercial banks and credit card companies to determine whether the consumer is granted credit on the basis of predefined criteria [Thomas,2002]. Credit ratings can be divided into two distinct types. The first type is practical rating where credit applicants are classified as good or bad. The data used for the model is composed of general financial and demographic information about loan applicants. In contrast, the second type deals with the transactions with existing customers and other information. Payment history information is also used here that is different from that of the first type; because it depends on the refund method of customer. Credit rating is a number that provides a person's credit based on quantitative analysis of his credit history and other criteria; it describes the probability of refunding the loan by the borrower.

After expert system evaluations, finally, facilities granting state is classified into five categories: excellent, good, fair, bad and very bad. Granting facilities to the applicant has attained excellent or good degree will have the lowest risk. Granting facilities to the applicant has attained fair degree will have some extent of risk; by strengthening of documents, this risk will be prevented. Granting facilities to the applicant has attained bad and very bad degree will have the highest extent of risk; and banks should not provide them facilities.

Systematic evaluation systems such as credit rating reduce the role of human (impact of human error) in the evaluation and thus potentially reduce the risk and cost of granting credit. Due to the shorter process of granting loans, customers will attract and the demand for credit will be increased.

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