

EasyLoanDecision: A Expert System for Consumer loan

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Abstract:

The banks, due to the large supply and demand for loans, have a great need for a more efficient and effective way of working, and at the same time to offer high quality to their customers. Banks in R. Macedonia uses information technologies in their operations, but there is room and opportunities for their application on a larger scale if mistrust is reduced and the awareness of employees and authorities is increased. Expert systems are an appropriate way to support lending decisions, as they use expert knowledge in decision-making. Due to their interface, these systems are easy to use and do not require much credit expertise from their users. In this paper we proposed an expert system, for supporting the decision-making process for the application for consumer credit.

Keywords:

expert system, knowledge-based system, banking sector, consumer loan

1. Introduction

Banks are the most important participants in the financial system and the largest financial institutions, measured by their participation in the total assets of the financial sector. They are the main pillar of the financial sector in the country, contribute to the distribution of liquidity in the economic sector, and indirectly stimulate the economy of a country through lending. A bank's main activity is the collection of deposits and the granting of loans to make a profit, as well as the execution of payment transactions. Lending loan to anyone could be a risky activity for the banks. Therefore, there should be an appropriate method through which the risk of lending loan to any individual can be evaluated. In credit assessment of customers number of factor are considered like sex, age, education, marital status, career, no return check, deposit account, deposit period (month), average salary [1].

Also, the application of IT improves processes in many segments of operations. Expert knowledge is a combination of a theoretical understanding of the problem and a collection of heuristic problem-solving rules that experience has shown to be effective in the domain [2]. So, the expert systems dramatically expand computer efficiency, utility, and range in financial sector. Processes such as credit decision-making, but also other activities such as various transactions, expert system facilitate and contribute to the performance of those tasks with greater accuracy, speed, and without bias. The primary goal of the expert systems is to make expertise available to decision makers and technicians.

The paper proposes an expert system to support decision-making for consumer credit applications. The system will assist the loan officer in risk assessment and completion of the loan package and application of the proposed expert systems can improve efficiency in credit decision-making. The paper is organized as follows. The second section depicts used research methodology, upgraded knowledge of important topics, and gives a short overview of realized research. The following section describes the proposed expert system EasyLoanDecision, for supporting the decision-making process for approval/rejection the application for consumer credit. Finally, the last section provides concluding remarks.

2. Background

2.1. Function of banks in the financial sector

Banks have a central role in the economic system, because they perform certain activities, which are of vital importance for the functioning of the economy as: financial intermediaries to customers and partners; bearers in payment transactions in the payment sector; have a special role in monetary policy; and offer some additional or special services to economic agents [3]. According to the Macedonian Law on Banks "bank is a legal entity with permission from the governor of the National Bank of Macedonia established in accordance with the provisions of this law, whose main activity is collecting deposits and other returnable sources of funds from the public and granting loans in its own name and for own account" [4]. However, the legal definition does not cover the non-banking activities that banks perform in large numbers. According to the functional approach, banks are institutions that offer clients various banking services such as: financial intermediation between clients and partners; they are carriers in the payment turnover in the payment sector; have a special role in monetary policy; and offer some additional or special services to economic agents [3]. The functions performed by a bank can be divided into three categories: active, passive, and neutral banking operations. Our focus is on active banking operation, the operations in which the bank is a creditor of its client, for example issuing a loan. The word loan ("credere"), which means trust, refers to legal certainty. It is a private legal act by which an economic entity, for a certain period, transfers certain real economic goods or money into the ownership of another economic entity, with the obligation to return them with a certain compensation (interest) [5].

A natural or legal entity can apply as a borrower. Loans to the population represent financial assets that banks, and other financial institutions lend to individuals and households. However, according to the purpose, there are several types of loans, which are intended for financing current consumption or for the purchase of durable products, such as: Consumer loans (dedicated consumer loans or non-purpose consumer loans, revolving loans, car loans, housing loans, etc.

The procedure for concluding a loan agreement takes place in several stages: it starts with submitting a request from the client to the bank; the client submits the necessary/requested documentation together with the request; verification of submitted documents, which include: personal identification document, employment certificate and salary certificate, certified by the employer, latest invoices from overhead expenses confirming that they are regularly paid; based on the attached documents, the bank analyses financial aspects, evaluates the creditworthiness of the client and collateral analysis (possibility of administrative ban on salary or guarantors, or secured deposit or pledge of securities or real estate mortgage); if the assessment is positive, the next phase is reached - concluding a loan agreement; monitors the transfer of the credit and enabling the borrower to use it; the last stage is the repayment of the loan by the borrower [6].

2.2. Expert system in banking sector

Expert systems are knowledge-based systems that attempt to act as experts in a problem domain. They are intelligent computer programs that mimic the way experts solve problems, make decisions, or perform a task that requires domain expertise, using both facts and heuristics [7]. The expert system is based on the paradigm Expert + Knowledge = Advice. From the user's point of view, the expert system acts as an intelligent consultant in a specific area.

Goodwin and Wright point out that two types of expert systems can be distinguished: The first are basically academic research projects where difficult or potentially intractable problems are solved so that new ways of representation or extraction must be developed of knowledge; The second set of systems are those built by consultants using commercially developed expert system shells. They are easy to program in the same way that word processing or spreadsheet programs provide easy-to-use tools [8]. Based on the problem they address and the area in which they are applied Several generic categories of expert systems can be defined: Classification Systems, Diagnostic Systems, Monitoring Systems, Design Process Control Systems, etc. [9], [10].

The banking industry has a wide variety of business lines and needs urgent management of its expertise. For banking industry more appropriate is the second set of system, according to Goodwin and Wright. They need to make expertise cheap and accessible and ensure uniformity in decision-making across the organization. The literature suggests that expert systems have a major role and application in the banking sector in the US, Europe, and Japan. The list of applications for expert systems is extensive: Credit analysis for commercial and financial loans; Risk analysis and loan clearance, including loan monitoring; Client Profile and Investment Advisory; Portfolio management; Risk analysis for securities offerings; Analysis of securities and evaluation of investment exposure; Estate planning and tax consulting; Financial planning assistance, including resource allocation; Support for foreign exchange trading and analysis of foreign exchange exposure, etc. [8].

The credit risk estimation problem is a very challenging and important financial analysis problem, and research shows that expert systems perform very well for this complex and unstructured problem compared to more traditional statistical approaches. Research on the credit risk of banks in different countries, regardless of whether they are developing or developed, shows that in many countries exposed to financial crises, financial defaults on overdue loans have a great impact [2].

Expert systems solve the problem of credit risk assessment and credit package completion by applying expert knowledge and used as a decision support system, making expertise available to decision makers. The expert knowledge embedded in expert systems is a combination of a theoretical understanding of the problem and a set of heuristic rules for solving problems that experience has shown to be effective in the domain. Expert systems covering the field of lending have the ability to recognize a typical task in a particular problem they are solving. They also possess some qualities, which are due to heuristic knowledge. Based on this knowledge, they can recognize the fastest way to reach a solution, as well as the right approach in solving problems, even if the data is incomplete [9].

For the development of the Expert System for evaluation and support of credit decisions, two activities are crucial: acquiring knowledge for building the knowledge base in the development environment; and integrating the knowledge base with the user interface in the consultation environment. In the development environment, the knowledge engineer first analyzes all the available documents related to the subject area which constitutes indirect knowledge acquisition, and then through knowledge acquisition sessions, he extracts knowledge from experts by directly asking them how they do their work in the domain. The extracted knowledge is checked and updated by experts in the domain and then that knowledge is incorporated into the system [7]. One of the most challenging activities in building expert systems is the representation of knowledge in the system [13].

C Language Integrated Production System (CLIPS) is a rules-based programming language and is a low-cost option for developing and delivering expert systems across a wide range of hardware platforms as well as other programs where heuristics are easier to implement and maintain than algorithmic solutions [14]. However, our pick for expert system's development tool is Exsys Corvid because it is designed to enable experts to develop powerful, interactive advisory applications quickly and easily through a powerful development environment that can be quickly learned and implemented. This tool allows converting complex decision-making processes into an interactive form that can be easily embedded in a website [15]. The steps in building the system are very similar to an expert's explanation of how a decision is made. A rule-based system can be simply created by using a set of assertions and a set of rules that specify how to act on the assertion set. Rules are expressed as a set of If-Then statements (called If-Then rules) [16]. By applying some of (or all) seven different types of variables, of which the most used are: Static List, Numeric and Confidence; and logical blocks that allow to define, organize, and structure information for decision-making in logically connected blocks, is very easily developed the expert system. The inference engine of the expert system, imitates the human brain and intuitively combines heuristics, combining individual rules to solve larger problems, makes a combination of solutions, analyses all the answers received, as well as all the data from each point of view to get best solution.

3. Research Methodology

The first step, before starting the development of an expert system, was to collect and analyses data about the situation in the banking sector in the Republic of Macedonia and the need for such a system.

For this purpose, 3 questionnaires were used as research instruments: Questionnaire number 1 and Questionnaire number 2 consisting of 10 questions for employs in the banking and financial sector. The third survey questionnaire covered 150 respondents who are direct or indirect applicants for loans on the market, persons who have already used loans, use, or intend to use loans from banks and other financial institutions in the Republic of Macedonia.

The research was conducted over a period of 5 months and cover 6 different cities in the southwestern region of the Republic, with effort not to select banks or savings banks based on a certain criteria. In the research process, 6 banks and 6 financial companies that function and work on the financial market in the Republic of Macedonia were included. The sample is representative and geographically distributed across several cities in the country, so the conclusions can be generalized.

The data, collected by the research instrument, after their systematization and grouping, were statistically processed.

After the analysis of the collected data and the obtained presentation of the situation in the banking sector in the Republic of Macedonia in the part of the application of IT during the processing of credit requests, we moved to acquiring knowledge for building a knowledge base for credit decision. Then we followed the selection of a tool for development of an expert system and finally we moved on to develop an expert system for consumer loan.

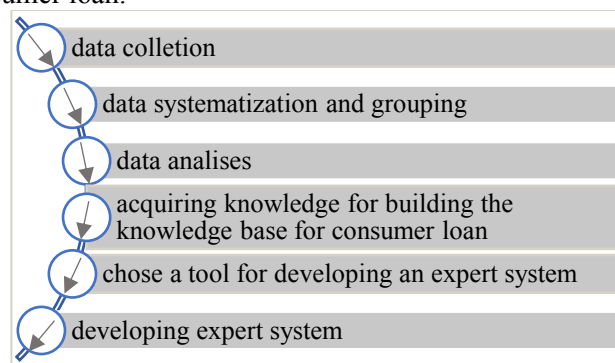


Figure 1: Step of expert system development for consumer loan

4. Expert system for consumer credit: EasyLoanDecision

The conducted analysis of the collected data gave an overview of the conditions in the banking sector in the Republic of Macedonia in the area of IT application, credit processing time, the need for staff to work on credit requests, the application of expert systems in the process of processing credit requests, etc.

In general, the largest percentage of the respondents agree that the established written credit policy allows them to be unified in lending and that in this way the bank will ensure that the regulatory standards are met. Respondents (over 90%) fully agree that banks should aim to achieve profit with the lowest possible risk through the marketing of products and services.

According to a large part of the respondents, consumer loans are offered mostly by banks in the Republic of Macedonia. IT is used in the process of making decisions on credit approval in the banking sector. However, a large part of the respondents stated that they are not sufficiently familiar with the functionality and functioning of expert systems in the lending process.

Regarding the duration of the process from application to receiving an answer for the requested loan, they stated that it lasts from 10-30 days. A decision according to the respondents, is mainly made by the official with the help of computer tools. Half of the respondents answered that the training for one person takes between 9-18 months, which is quite a long period considering that 90% of the respondents

answered that it is difficult to find a person with adequate knowledge. Almost all respondents stated that in the long term, it is necessary to use expert systems when making a decision to approve or reject a loan request.

Citizens and legal entities in the Republic of Macedonia are interested in loans, and the majority of respondents answered that they are currently consumers of credit, but as the biggest problem they point to the high interest rates (more than 60% of the respondents) and the lending conditions that offered by the banks, especially the long procedure for the loan and the duration of the loan approval.

To facilitate and speed up the lending procedure, this paper proposes an expert system for supporting the decision-making process for approval or rejection of the application for consumer credit.

In addition, based on the detailed analysis of the procedure for obtaining a consumer loan, the various tools for developing an expert system were considered. An Exsys Corvid shell was chosen.

The result of realized research and upgraded knowledge is Expert system EasyLoanDecision. The decision tree for Expert system EasyLoanDecision is given on Figure 2.

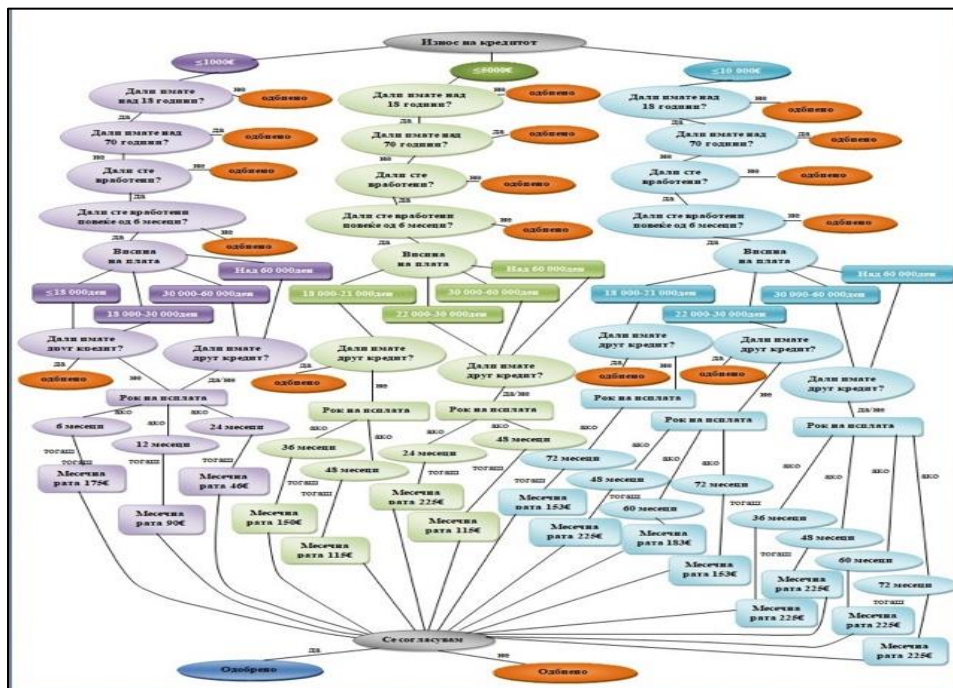


Figure 2. Decision tree for a decision making for a consumer loan.

The decision for a positive/negative response to the loan application depends on several parameters such as: the age of the applicant, the work status (employed/unemployed), the duration of the work status as an employee, the amount of personal income, other debts (loans) as well as the number of loan repayment installments (Figure 2).

Two type of variables was used in ExsysCorvid for EasyLoanDecision: Static list, Numeric value, and Confidence value. Total number of used variables is 17. The decision-making logic is described and built using nodes that represent the statements in the If..Then rule (Figure 3).

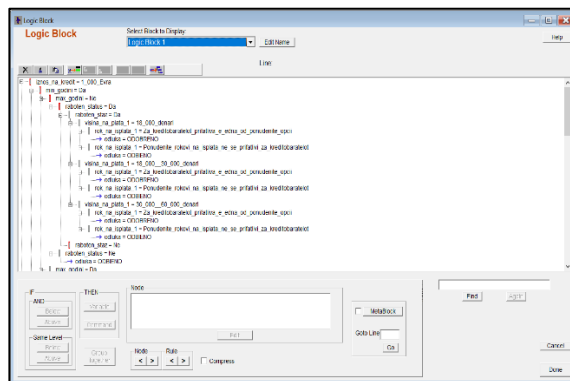


Figure 3. The logic block of EasyLoanDecision.

The command block controls the system. Unlike, the logic block in a system tells it HOW to do something and the way the activities should be carried out, the command block tells it WHAT to do and WHEN the given activities are to be carried out. The EasyCreditDecision based on the built-in logic (If..Then rules) and the answers given by the credit analysts to the questions asked by the expert system for the specific credit request, are helping the decision making of the request (Figure 4 and Figure 5).

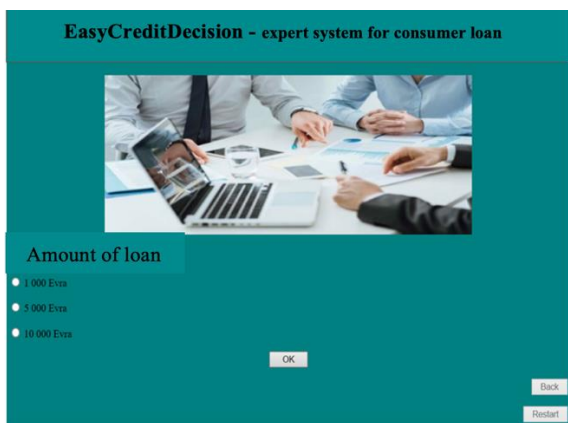


Figure 4. Communication between ES and credit analysts



Figure 5. Expert system recommendation

5. Conclusions

The conducted research shows that the citizens and the legal entities in the Republic of Macedonia are interested in loans, and many respondents answered that they are currently consumers of credit. Mostly, the loan's users are not satisfied of the lending conditions that offered by the banks and the big procedure for the loan, as well the duration of the loan approval.

The professional staff of the bank should make a good analysis of each borrower and evaluate whether the potential borrower is a good payer, i.e., that there is no risk (the risk is relatively small) that the borrower will not pay the principal and interest on the approved loan on time. Banks use IT in the decision-making process during the credit approval process, but do not use expert systems. There are not enough professionals on the market who are suitable for the position of considering requests and making credit decisions, and the training for one person to be qualified to perform that task is on average between 6 -10 months.

To facilitate and speed up the lending procedure, this paper proposes an expert system EasyLoanDecision for supporting the decision-making process for approval/rejection of the application for consumer credit. This expert system embeds the procedure for concluding a loan agreement in accordance with the established written credit policy. The application of an expert system in the process of processing the credit request will contribute to increase the effectiveness and efficiency of the banks in this segment of their operations.

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