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**CALCULATION OF THE AMOUNT OF DAMAGE THAT BANK
EMPLOYEES MAY CAUSE**

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Abstract: The authors of the article identified the problem of banks is that there are a number of employees who violate the rules of the bank, which cause him damage. These violations are detrimental to the bank as its funds are spent on investigation of the violation itself, compensation of losses, selection and training of a new employee, repair of reputational losses. Therefore, a method for determining the probability of damage to a new employee of the bank was developed. For this purpose it is suggested to use statistics of previous violations, which were found in the employees who already work at this bank.

Building a model of the level of damage that a new employee can provide if he or she commits a breach consists of drawing up tables that, in addition to the level of harm, include characteristics of the employee himself, such as incident description, incident date, employee's date of birth, gender, position, work experience : at bank and general, level of satisfaction with working conditions, planning to change jobs, monthly income, number of dependents (children, spouse, parents, etc.), monthly payments (mortgage, loan, alimony, etc.), date of inc. entu.

The table allows you to use a clustering algorithm that was implemented using Statistica software. The breakdown of all the employees who caused damage in the classes allows finding the average level of harm for each class. According to the results of clustering, the coefficients of linear separation functions were calculated. Now, by entering into a contract with a new employee, you can immediately determine which class of possible losses can be attributed. For this purpose, the data of the new employee is calculated by all the separate division functions. The split

function that takes the most value and indicates which class the new employee is assigned to. Comparison of the possible volume of losses with the current level of working capital of the branch where it should work will allow the management of the bank to make a decision on the possibility of concluding employment contracts. Python's interpreted object-oriented programming language and its standard Tkinter library were used to automate the calculations to create the user interface. The developed program was used for banking activities of KB Privatbank.

Keywords: risk management, loss, cluster analysis, financial analysis, distributive functions, forecasting, probability determination.

Operational risk is inextricably linked to banking, in particular due to its complexity. Operational risk is the probability of losses or additional losses or failure to receive planned income due to deficiencies or errors in the organization of internal processes, intentional or unintentional actions of bank employees or other persons, malfunctions in the operation of the bank's information systems, or due to the influence of external factors. Damages can be caused through the following actions by employees: fraud - illegal actions aimed at taking over bank property, financial resources or property by deception or abuse of trust; abuse – intentional violation of the bank's regulatory documents (including Credit Procedures), exceeding one's official powers and/or powers when carrying out banking operations; conflict of interest – the presence of an employee's undisclosed economic or personal interest in a transaction that negatively affects the bank.

To implement the set tasks, a methodology was developed for determining the extent of the possible loss that a new employee can provide to the bank, based on the methodology developed in [5].

For this purpose, it is suggested to follow the following algorithm:

1. Use the statistics of previous violations that were discovered after they were fixed.
2. Build tables of the level of damage caused by bank employees, which, in addition to the level of damage, includes characteristics of the employees.

3. Use the clustering algorithm, by dividing all employees who caused damage into classes, allows you to find the average level of damage for each class.

4. Calculate the coefficients of linear separable functions.

5. When concluding an employment contract with a new employee, assign him to a certain class by substituting employee data into separate functions. A separate function that will take the largest value and means to which class the new employee is assigned.

6. Compare the possible amount of losses with the current level of working capital of the branch where this employee is to work, which will allow the bank's management to make a decision on the possibility of concluding employment contracts.

The proposed algorithm was used to analyze and forecast the unprofitability of new employees of Privatbank CB.

The amount of damage caused to the bank from incidents caused by employees, according to the method of estimating the time spent on eliminating the incident, according to the bank's internal documents, is estimated as the number of lost transactions and calculated as

$$\begin{aligned} \text{Number of lost transactions} &= \text{Actual incident resolution time} + \\ &+ \text{Average number of transactions per hour} + \text{The cost of one transaction} \end{aligned}$$

The actual incident resolution time is calculated:

$$\begin{aligned} \text{Actual incident resolution time} &= \\ &= \text{Incident closure time} - \text{The time of the incident} \end{aligned}$$

To compile the table, a survey of Privatbank employees responsible for human resources was conducted. The questionnaire contained the following questions: Description of the incident; The date of the incident; Date of birth; Sex; Position; Work experience: in the bank and general; Level of satisfaction with working conditions; Did you plan to change the place of work; Monthly income; Number of dependents (children, spouse, parents, etc.); Monthly payments (mortgage, loan, alimony, rent, etc.); Incident closure date. The sample had 57 responses.

Based on the raw data, a correlation analysis was performed using MS Excel. According to the results of the analysis, it can be concluded that the age of the employee, the amount of monthly payments, the level of satisfaction with working conditions have the greatest influence on the size of the loss, the amount of income, gender and assumptions about changing the place of work have a slightly smaller influence. The seniority and the number of dependents of the employee have the least influence.

The purpose of further analysis is to divide employees into groups. Employees belonging to the same group are equally likely to commit a situation that will result in the bank incurring a loss. Cluster analysis using the STATASTICA package was used to perform this task.

The sample formed five clusters. When clustering, the largest contribution is made by: gender - 0.52; date of birth - 0.338; level of satisfaction with working conditions – 0.112; the ratio of monthly payments to the employee's monthly earnings is 0.032; plans to change the place of work - 0.015; number of dependents 0.0119; seniority - 0.004; age is 0.0001.

The obtained divided into clusters must be sorted. Ordered data is used, in this case, to create distribution functions.

In order to construct linear separation functions, it is first necessary to create a column containing an additional variable - the cluster separation function. In the calculations, it is marked as Y^* .

When calculating linear regression for a certain cluster, the value Y^* has bits assigned the value 100 only for the data of this cluster, and for the data of the remaining clusters - the value $Y^* = 0$ is assigned. The next step is to construct the linear regression dependence of Y^* on the input factors according to the algorithm, described in [3].

As a result of carrying out the specified sequence of actions, 5 dependencies were obtained for all clusters:

$$Y_1^* = 0,065X_1 + 0,997X_2 - 7,035X_3 - 0,836X_4 - 1,46X_5 - 6,97X_6 - 0,001X_7 + 7,259X_8 + 0,007X_9 - 37,72X_{10}$$

$$Y_2^* = -0,34X_1 - 0,295X_2 + 5,83X_3 - 0,19X_4 - 0,73X_5 - 7,078X_6 + 0,0007X_7 + 0,556X_8 + 0,0009X_9 + 0,243X_{10}$$

$$Y_3^* = -0,0029X_1 + 1,48X_2 + 7,07X_3 - 0,637X_4 - 1,297X_5 + 13,76X_6 - 0,002X_7 + 6,674X_8 + 0,002X_9 - 54,25X_{10}$$

$$Y_4^* = 0,73X_1 - 0,136X_2 + 11,99X_3 - 1,899X_4 + 6,375X_5 + 10,41X_6 - 0,001X_7 - 3,295X_8 - 0,007X_9 + 94,635X_{10}$$

$$Y_5^* = 0,25X_1 - 0,864X_2 - 5,153X_3 + 1,98X_4 - 0,589X_5 - 0,17X_6 + 0,005X_7 - 7,396X_8 - 0,004X_9 + 22,929X_{10}$$

It is also necessary to calculate the average amount of damage for each cluster (Table 1):

Table 1

The average amount of damage by clusters, hryvnias

The average amount of damage for 1 cluster	The average amount of damage for 2 cluster	The average amount of damage for 3 cluster	The average amount of damage for 4 cluster	The average amount of damage for 5 cluster
3 487,14	18 133,33	10 030,77	1 929,63	2 653,85

To determine the probability of a loss assignment, the bank employee used the following formula:

$$P = \frac{\textit{The average amount of damage by cluster}}{\textit{The average amount of funds passing through an employee per day}}$$

The average amount of funds passing through one employee per day was calculated as a ratio:

$$\textit{Annual budget of the direction} = \frac{\textit{Annual budget of the direction}}{\textit{Number of employees}} \div \textit{Number of working days in a year}$$

An acceptable probability of employment in the division is up to 30%, according to a survey of employees of the labor resources department.

Based on the developed methodology, an information system was created that

allows bank employees responsible for human resources to automate the calculation of the probability of a loss assignment by new employees.

After the calculation is completed, the system issues a message about the possibility of accepting this employee in the specified unit (Fig. 1).

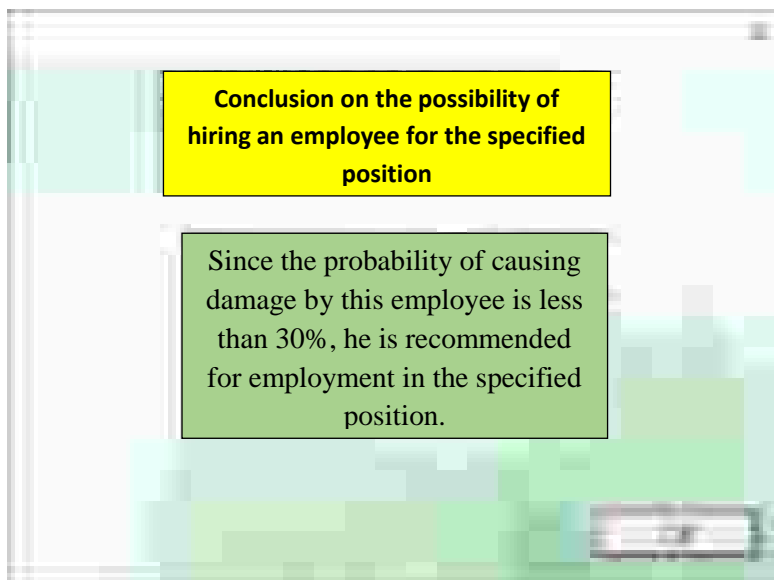


Fig. 1. Conclusion of the information system

Conclusions. Thus, data clustering makes it possible to first identify to which risk group a new employee belongs, and then, based on the circulating funds that pass through the department where the employee is supposed to work, makes it possible to understand whether the bank can allow to hire this person at that moment. The developed model allows you to estimate such a probability and determine a behavior strategy to minimize the occurrence of similar situations.

In conditions when several new employees come to the bank at once, this model is the most effective for quick decision-making.

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