

# **Intelligent Risk Assessment of Banking Services in the Transition to a Digital Economy Using the Example of Banks in Tajikistan**

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## **ABSTRACT**

The digitalization of the banking sector, which consists of the use of digital tools in banking services, takes banks and other financial institutions to a new level of development. The most important component of digital technologies is intelligent model that reduce the role of people in making various decisions in any banking activity. Risk assessment in the provision of banking services to a client is the most important business process of any commercial bank. The problem of assessing the quality of the borrower in the context of digitalization of the activities of financial institutions goes to a different level, as traditional sources of customer data become insufficient. As part of this work, it is proposed to build a digital model for assessing the class of the borrower, on the one hand, based on fuzzy management technologies, and on the other, on data mining using the SAP cloud system. The proposed model allows you to rank borrowers by quality, distributing them by class. The article shows the economic efficiency of the constructed integrated model based on the data of the commercial bank of the Republic of Tajikistan.

**Keywords:** *digital economy, digital assessment, banking services, risks, fuzzy management technologies*

## **1. INTRODUCTION**

In the face of increasing risks of the global economy, the active use of digital technologies and factors of socio-economic development as a tool for programming the directions of the formation of the economy of society brings us closer to the digital economy.

Today, in the conditions of a decline in lending amid economic instability, the financial capabilities of borrowers are declining and credit history is deteriorating. National and commercial banks need to use digital tools to increase the efficiency of evaluating potential borrowers at the stage of issuing a loan. The digitalization of assessment systems will help to comprehensively analyze and aggregate information on the borrower's credit capabilities in a shorter time, thereby reducing the risks of the entire process of providing banking services for approving and issuing a loan.

Risk management for the provision of banking services is becoming one of the most important factors in maintaining the competitiveness of commercial banks in the fight for solvent customers - individuals and legal entities.

The creation of intelligent risk assessment methods in the provision of banking services that meet current trends in the digitalization of the economy is an urgent and timely task.

This work aims to develop a model of intelligent risk assessment in banking services using the example of

Orienbank OJSC and analyze using digital tools SAP Analytic Cloud and Fuzzy Tech fuzzy management system.

## **2. LITERATURE REVIEW**

First of all, it is necessary to determine the basic concepts for disclosing the essence of the selected topic.

In 1995, an American scientist from the University of Massachusetts Nicholas Negroponte proposed to understand the term digital economy as “the transition from the movement and processing of atoms of the material world to the processing of bits of the virtual, whose goods are weightless and instantly move to anywhere in the world where the Internet is” [4].

The digital economy is a kind of supermodel of the traditional economy and can be considered as a driving force for economic growth and potential that can influence entire areas of business, the labor market, and people's lifestyle [1, 3, 5].

Digitalization is the process of transition of an enterprise or an entire economic industry to new models of business processes, management and production methods based on digital technologies [3].

Banking service risk is an activity carried out in conditions of uncertainty, aimed at obtaining a high positive financial result and overcoming or minimizing possible adverse consequences [2].

One of the most important components of banking risk management systems since the first half of the 90s has been credit scoring. Credit scoring models are becoming more accurate every year because they use a larger number of predictors built based on analytics of data accumulated by the bank from various sources. Credit scoring is a process of assessing the level of credit risk using mathematical methods, the result of which is to increase the speed and effectiveness of decisions on approving a loan, and reduce the likelihood of its default [7]. In the context of the digitalization of the economy, more and more often smart technologies are used as credit scoring models that assess the risks of banking services related to the process of approving and issuing loans.

### 3. RESEARCH METHODS

To assess risks in the provision of banking services, several approaches are used, each of which has advantages and disadvantages. The most commonly used statistical, analytical, and expert approaches [7-14].

The statistical approach determines the frequency of occurrence of bank risks and their dependence on any factors (both external and internal) [7-9]. This approach can be used to assess the risk of credit operations in all their diversity. An expert approach involves discussing the situation of a particular case with a group of specially selected experts. The expert group individually assesses the likelihood of potential risks from the list provided, based on any rating system.

Expert assessments are analyzed for inconsistency. They must satisfy the following rule: "the maximum allowable difference between the assessments of two experts for any type of risk should not exceed a certain threshold, which allows us to eliminate unacceptable differences in assessments by experts of the likelihood of a particular risk" [14]. Analytical methods of risk assessment allow determining the probability of losses based on mathematical and informational intelligent models and are used mainly for the analysis of banking risks of any type [10]. To assess the credit risks associated with borrowers, as a rule, two methods are used - most often in combination. These are subjective expert assessments and scoring models based on mathematical models.

Each of these approaches has advantages and disadvantages. For example, any statistical methods take

into account past results but do not always answer how a particular borrower would behave if the loan was approved. The economic situation is constantly changing. Therefore, an assessment of previous data does not always give an accurate forecast.

A computer program is being created combining some approaches to assess the risk of banking services. Most financial institutions have their programs, and the methods laid down in them are a trade secret.

The article includes the construction of a model of a possible risk assessment system for the provision of banking services, and now we turn to the description and implementation.

### 4. RESULTS

Open Joint-Stock Company Orienbank is one of the oldest banks in the republic. At the end of the 80s, Stroybank and Gosbank were reorganized into the State Bank of the Republic of Tajikistan and universal specialized banks, for example, the State Industrial Construction Bank Tajikpromstroybank, designed to provide comprehensive services to all industrial enterprises of the republic, exploration, fuel and energy complex of construction organizations, supply- sales and transport enterprises, and enterprises of the Ministry of Communications.

In April 1991, Tajikpromstroybank began to corporatize, and on December 29, 1991, it was transformed into the Tajik Joint-Stock Commercial Industrial Construction Bank "Orienbank", registered by the National Bank of the Republic of Tajikistan, and received license No. 1.

On April 5, 2002 TAK PSB "Orienbank" was renamed into Open Joint-Stock Company "Orienbank".

As of June 30, 2019, the bank serves more than 100 thousand corporate customers and 1.5 million individuals. At the beginning of building a model of an automated assessment system, a formalized assessment of the borrower is carried out on the based on a loan application and an assessment of the financial condition, designed to increase the objectivity of the point system. The positions of sections of the loan application are evaluated on a five-point scale. Each estimated position of the loan application has the weight shown in table 1.

The rating is calculated by multiplying the position score by its weight. A loan is classified based on the ratio of the borrower rating to the security rating.

**Table 1 The scale of the weights of the positions in the analysis of the borrower in OJSC «Orienbank»**

Estimated Position	Position weight
Security	15
Assessment of financial condition	10
Profit/Loss	5
Sales revenue	5
Bank account turnover	15
Receivables	5
Other creditors	10
Bank loans	10
Market position	5
Major suppliers/buyers	5
Cash flow	15

The weights of each criterion are taken into account when setting variables. The rules emphasize the importance of each of them. Each criterion will be spelled out with a minimum score: minimum score (1) \* weight of the criterion; and maximum: maximum score (5) \* weight of the criterion.

We offer the following 5 classes for evaluating the borrower.

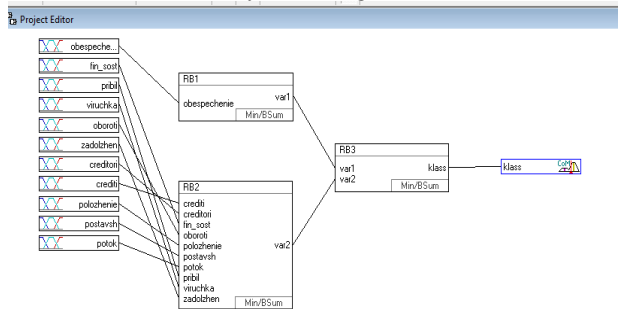
I “Best” - a customer of first-class creditworthiness; II “Good” – high-quality loan; III “Satisfactory” - a loan of satisfactory quality; IV “Problem” - a problem loan; V “Worst” - a loan of extremely low quality.

The loan class is made up of the borrower rating and security rating. The security rating includes the criterion “Security”. The borrower rating is formed after analysis of the remaining ten criteria.

Since the security criterion is a separate line, it must be put out in the first block of rules. The remaining ten criteria will go to the second block. So, the first block calculates security, the second - assessment of financial condition, bank loans, other creditors, market position, bank account turnover, cash flow, profit/loss, sales revenue, receivables, major suppliers/buyers.

To increase the objectivity of the assessment, it was decided to use the Fuzzy Tech program. It allows you to aggregate scores for individual valued items based on fuzzy control technologies.

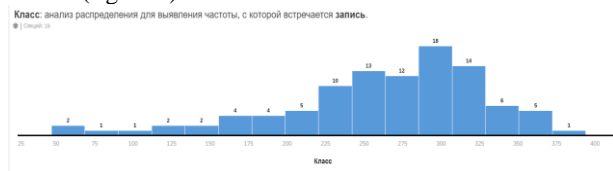
The final model in fuzzyTECH (figure 1):



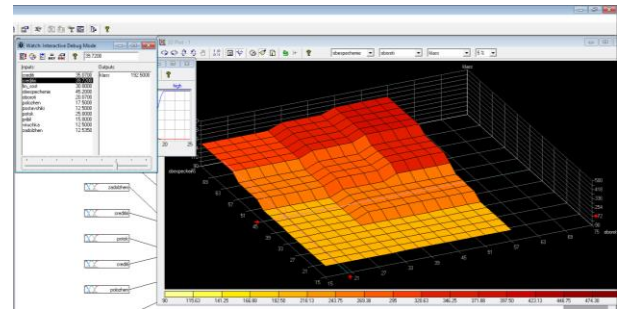
**Figure 1** The final digital model of fuzzy management classification of borrowers

After the configuration of all variables and blocks in the final model is completed, the configuration of rule blocks begins.

Using the model is implemented in an interactive mode, in which it is possible to change the values of each variable and create a surface graph for the visual display of the results (figure 2).



**Figure 2** Frequencies of the Class parameter - the second data set



**Figure 3** Interactive digital model setup

Windows for viewing the results of fuzzy inference in two- and three-parameter versions can be used for a general analysis of the efficiency of the fuzzy system. Figure 2 shows a three-parameter version of the presentation of the results of fuzzy inference. This view allows us to analyze the dependence of the values of the output variable on the values of two input variables of the fuzzy control system.

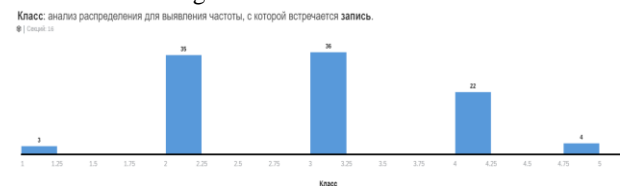
The 3D diagram shows how the variables “Financial Security” and “Bank account turnover” affect the output variable and how the borrower class changes as a result.

For the intelligent analysis of the results, the cloud-based solution SAP Analytics Cloud was used. SAP Analytics Cloud is a cloud solution that combines the functions of planning, business intelligence, and predictive analysis.

The variables were sequentially entered and the output variable was recorded to load the data for analysis into the system. Two types of data were used for analysis. In the first, the output variable was converted to its corresponding class. In the second, the output variable was left unchanged. The required tables were filled in MS Excel for import into the SAP system.

After collecting the necessary data in an Excel sheet, it was loaded into the system.

In both cases, a class was chosen as an indicator. Next, let's move on to intelligent discovery to get information about the influence of basic variables on a selected indicator in the log dataset.



**Figure 4** Frequencies of the Class parameter - the first data set



**Figure 5** Diagram of influence on the class of the borrower

The following results were obtained: we notice in the first diagram (Figure 3) that the least companies were assigned to the fifth-worst group, four results were assigned to the best group. Most of the companies were assigned to 3 and 4 groups. Such groups, as a rule, require additional research to create confidence that the issued loan will be paid on time and in the right amount.

The second graph (Figure 4) was created using the second data block with the source class. It also shows the predominance of the average class value, but with a shift in a smaller direction to worse results.

The system also revealed a large influence of the variable “market position” on the class of the borrower company (figure 5).

We can conclude that the created model will be able to divide borrowers into groups to determine their degree of a problem for the bank.

## 5. CONCLUSION

Based on the material studied and the data of Orienbank OJSC, a model was built and implemented in fuzzyTECH. The analysis of the model was performed in the SAP Analytics Cloud system using real data about borrowers. As part of building the model, 11 input variables, 2 intermediate variables, 1 output variable, and 3 rule blocks were used.

Using the implementation of the obtained model with real data, the criteria for building the risks of providing banking services were determined and an interactive digital model based on fuzzy management technologies was built. The functioning of this model was tested using the SAP Analytic Cloud Intelligent Assessment Tool, which validated the parameters of the digital model.

## REFERENCES

[1] M. Bahl, *The Work Ahead: The Future of Businesses and Jobs in Asia Pacific’s Digital Economy*. Chennai: Cognizant, 2016 <https://www.cognizant.com/whitepapers/the-work-ahead-the-future-of-business-and-jobs-in-asia-pacifics-digital-economy-codex2255.pdf>

[2] *Biznes-zhurnal BIT. Biznes&Informacionnye tekhnologii*, <http://bit.samag.ru/uart/more/67>

[3] L.S. Lobach, *Bankovskie riski: teoriya i sushchnostnye harakteristiki*, Novye tekhnologii, 2016

[4] N. Negroponte, *Being Digital*, New York, Alfred A. Knopf, 1995, 243 p.

[5] D. Tapscott, *The digital economy: promise and peril in the age of networked intelligence*. NewYork: McGrawHill, ISBN 0-07-063342-8, 1997

[6] D. Hamilton, *The Transatlantic Digital Economy 2017: How and Why it Matters for the United States, Europe and the World*. Washington, DC: Center for Transatlantic Relations, 2017

[7] *Credit Scoring Guide*. Edited by Elizabeth Maze - M.: Grevtsov Publisher, 2008, 464 p.

[8] Y. Demyanyk, *Your Credit Score Is a Ranking, Not a Score*, *Economic Commentary*, 2010-16 (2010). URL: <https://www.clevelandfed.org/en/newsroom-andevents/publications/economic-commentary/economic-commentary-archives/2010-economiccommentaries/ec-201016-your-credit-score-is-a-ranking-not-a-score.aspx>.

[9] D.J. Hand, W.E. Henley, *Statistical Classification Methods in Consumer Credit Scoring: a Review*, *J. of the Royal Statistical Society: Series A (Statistics in Society)*, 160(3) (1997) 523-541

[10] C.L. Huang, M.C. Chen, C.J. Wang, *Credit Scoring with a Data Mining Approach Based on Support Vector Machines*, *Expert systems with applications*, vol. 33-4 (2007) 847-856

[11] J. Ross Quinlan, *S4.5: Programs for Machine learning*. Morgan Kaufmann Publishers, 1993

[12] D. Martens et al. *Comprehensible Credit Scoring Models Using Rule Extraction from Support Vector Machines*, *European J. of Operational Research*, vol.183-3 (2007) 1466-1476

[13] D.M. Nazarov, D.A. Azarov, Yu. P. Silin, *Nechetkaya ocenka ekonomicheskogo vliyaniya oboronno-promyshlennogo kompleksa Rossijskoj Federacii v kontekste «novogo normal'nogo» processa 2017 g. 20-ya Mezhdunarodnaya konferenciya IEEE po myagkim vychisleniyam i izmereniyam*, *SCM 2017 7970745*, pp. 856-858

[14] D. M. Nazarov, *Metodologiya nechetkoj mnozhestvennoj ocenki neyavnyh faktorov v deyatel'nosti predpriyatiya*, *Nauchnaya monografiya*. Ministerstvo nauki i obrazovaniya Rossijskoj Federacii, Ural'skij gosudarstvennyj ekonomicheskij universitet, Ekaterinburg: Izdatel'stvo Ural'skogo gosudarstvennogo ekonomicheskogo universiteta, 2016, 202 p.