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THE EFFECTIVENESS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING TECHNOLOGIES IN MANAGING NON-PERFORMING ASSETS IN THE BANKING SYSTEM

Khodjayev Husniddin Mukammilovich
Jizzakh State Pedagogical University, Uzbekistan

ABSTRACT

In the current era of rapid digital transformation in the global financial sector, the integration of advanced technologies—particularly artificial intelligence (AI) systems—into lending processes is becoming increasingly urgent. International experience demonstrates that the use of AI technologies enables banks not only to improve the accuracy of credit risk assessment, but also to significantly enhance the efficiency of asset portfolio monitoring and management. For countries with developing economies, including the Republic of Uzbekistan, these trends are opening up new opportunities to improve banking performance and strengthen the stability of the financial system.

INTRODUCTION

In accordance with the Strategy for Reforming the Banking System of the Republic of Uzbekistan for 2020–2025, one of the key priorities is the digitalization of banking services, the enhancement of transparency, and the improvement of risk management systems. However, in practice, the implementation of intelligent technologies in lending processes remains limited. Traditional scoring methods typically rely only on retrospective financial data and fail to adequately incorporate behavioral factors or alternative data sources. As a result, this shortcoming leads to an increase in the share of non-performing loans (NPL), a decline in bank profitability, and a growing regulatory burden.

In this context, there is a growing need for a comprehensive analysis of the impact of artificial intelligence technologies on the efficiency of credit operations in the banking sector. The relevance of this topic is further reinforced by the range of challenges currently facing commercial banks in Uzbekistan. These include intensifying competition, the necessity to comply with international standards (notably IFRS 9 and Basel III), and the need to respond swiftly to a volatile macroeconomic environment.

This study is aimed at adapting key principles to the specifics of Uzbekistan's banking practice. Particular attention is given to evaluating how the implementation of AI algorithms affects the default rate within loan portfolios, the accuracy of credit decision-making, and the overall efficiency of lending activities.

To analyze the impact of AI technologies on the efficiency of credit operations in Uzbekistan’s commercial banks, the model proposed by Ebrahimitorki and Kim (2025) has been adapted based on national characteristics and available empirical data.

The model integrates machine learning algorithms—specifically gradient boosting and neural network architectures—into traditional credit scoring systems. As input data, aggregated indicators from the reports of five major commercial banks in Uzbekistan for the period 2019–2024 were used. These indicators include:

– total volume of loans issued,
– level of overdue debt,
– indicators of bank profitability,
– efficiency of internal risk management processes.
The results of the analysis are presented in the following table:

Table 1.

Comparative Analysis of Credit Portfolio Indicators Before and After the Implementation of AI Technologies

Indicator	Before AI Implementation (2019–2021)	After AI Implementation (2022–2024)	Δ Change (percentage points)	Statistical Significance (p-value)
Share of Non-Performing Loans (NPL)	6.8%	4.2%	–2.6 p.p.	0.012
Recovery Rate on Restructured Loans	41.3%	58.7%	+17.4 p.p.	0.008
Average Credit Approval Time (in days)	7.5 days	3.2 days	–4.3 days	0.001
Return on Assets (ROA)	1.02%	1.48%	+0.46 p.p.	0.034
Accuracy of Scoring Assessment (AUC)	0.72	0.89	+0.17	0.005

The data presented in the table clearly demonstrates the positive impact of artificial intelligence (AI) models on the quality and efficiency of credit processes. In particular, the reduction in the non-performing loan (NPL) ratio from 6.8% to 4.2% indicates a significantly improved capacity to assess borrowers' creditworthiness. The increase in the recovery rate of restructured loans suggests enhanced identification of financially stable clients during the debt rehabilitation process. Moreover, the rise in the accuracy of credit scoring (AUC) from 0.72 to 0.89 confirms the high predictive power of machine learning models in identifying potential defaults. The near twofold decrease in loan application processing time has led to greater customer satisfaction and reduced operational costs.

These findings validate the hypothesis that AI-based approaches are highly effective in managing credit risk and optimizing business processes in the banking sector of Uzbekistan. The results serve as strong empirical evidence in support of the broader implementation of intelligent systems in internal banking operations.

The conducted research confirms the high efficiency of introducing AI technologies into the credit operation management processes of commercial banks in the Republic of Uzbekistan. Empirical evidence shows that the integration of AI algorithms significantly improves the key performance indicators of banking activity, including:
– reducing the share of non-performing loans;

– increasing the accuracy of scoring models;
– accelerating the credit decision-making process;
– improving the overall profitability of assets.

Notably, the use of AI technologies not only contributes to improved current financial outcomes but also provides a sustainable foundation for long-term credit risk mitigation. This is especially critical in an environment where lending volumes are rapidly increasing, and regulatory requirements—such as the implementation of IFRS 9 and Basel III standards—are intensifying.

The analytical results allow for the formulation of the following key conclusions:

1. AI technologies significantly enhance the accuracy of assessing borrowers' creditworthiness, thereby reducing the burden of loan-loss provisioning for banks.
2. The use of AI tools in loan restructuring and credit monitoring processes contributes to a lower share of problematic assets and improved recovery rates.
3. The digitalization of credit processes based on AI dramatically reduces administrative costs and accelerates the customer interaction cycle.

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