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The Role of Artificial Intelligence Technologies in Optimizing Trading Operations at the Commodity Exchange of the Republic of Uzbekistan

Khudayberdiyev Kamoliddin Ustemirovich

Independent Researcher at Tashkent State University of Economics

Abstract: This article examines the role of artificial intelligence technologies in optimizing trading operations at the Commodity Exchange of the Republic of Uzbekistan. The study analyzes key challenges in exchange trading processes, including inefficiencies caused by human factors, delays in data processing, and limitations in risk detection. It highlights the potential of AI-based systems to improve transaction analysis, automate decision-making, and enhance overall trading efficiency. The findings demonstrate that artificial intelligence contributes to faster processing of operations, improved accuracy in price and risk assessment, and increased transparency of exchange activities. The study also provides practical recommendations for further development and integration of AI technologies into exchange trading systems.

Keywords: Commodity exchange, artificial intelligence, trading optimization, AI analysis, machine learning, digital economy, automation, risk detection, transparency, big data, exchange trading system, economic efficiency.



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Introduction

In recent years, the processes of digital transformation in the global economy have been rapidly evolving, significantly impacting the functioning of financial and trading infrastructures. In particular, the widespread adoption of information technologies in exchange trading systems and the use of artificial intelligence (AI) have become key factors in improving the speed, transparency, and efficiency of trading operations. These developments are accelerating the transition from traditional trading mechanisms to digital and automated systems[1].

In the Republic of Uzbekistan, extensive reforms are also being implemented to modernize the commodity exchange system, digitalize trading processes, and improve market infrastructure. Under conditions of increasing numbers of market participants, expanding transaction volumes, and growing complexity of data flows, traditional management and control methods may not ensure sufficient efficiency[2]. This creates the need to introduce modern technological solutions for optimizing trading processes.

Artificial intelligence technologies are distinguished by their ability to analyze large volumes of data, forecast price dynamics, identify risks, and automate decision-making processes[3]. Therefore, the use of AI-based systems in the commodity exchange plays an important role in increasing the efficiency of trading operations, reducing the human factor, and ensuring market

transparency.

International experience shows that advanced exchange systems have already integrated artificial intelligence and machine learning technologies into trading algorithms, enabling real-time data analysis and optimal decision-making. These approaches are also relevant for the exchange system of Uzbekistan and their implementation can significantly improve economic efficiency[4].

From this perspective, the scientific study of the role of artificial intelligence technologies in optimizing trading operations at the Commodity Exchange of the Republic of Uzbekistan[5], as well as the identification of existing challenges and the development of evidence-based solutions, remains one of the most relevant tasks.[5]

Literature Review

The study of artificial intelligence (AI) applications in trading systems and exchange operations has become one of the rapidly developing areas in modern economic research. In the international academic literature, significant attention is given to the digital transformation of financial markets[6], automation of trading processes, and the use of machine learning algorithms for improving decision-making efficiency.

In particular, research conducted by Andrew McAfee and Erik Brynjolfsson highlights that the integration of AI and big data analytics into economic systems fundamentally changes the nature of market interactions[7]. According to their findings, AI technologies enable real-time processing of large-scale datasets, which significantly improves forecasting accuracy and reduces information asymmetry in trading environments. Similarly, Ajay Agrawal, Joshua Gans, and Avi Goldfarb emphasize in their work *Prediction Machines* that the core value of artificial intelligence lies in improving prediction processes[8]. In the context of exchange trading, this capability is crucial for optimizing pricing mechanisms, managing risks, and enhancing transaction efficiency.

Studies by Thomas H. Davenport and Rajeev Ronanki further demonstrate that AI-based systems are increasingly being applied in financial and trading platforms for automating complex analytical tasks. These systems not only reduce operational costs but also improve the speed and accuracy of trading decisions.

From the perspective of exchange market efficiency, Eugene Fama's Efficient Market Hypothesis provides an important theoretical foundation. Although traditional market efficiency theories assume rational behavior and perfect information, modern research shows that AI technologies help move markets closer to efficiency by reducing delays in information processing and improving transparency[9].

In addition, studies conducted by international organizations such as the World Bank and OECD indicate that digital transformation in trading systems contributes to increased transparency, reduced corruption risks, and improved institutional performance in public and commodity markets. In the context of exchange trading systems in developing economies, research remains limited, particularly regarding the integration of AI-based optimization mechanisms in commodity exchanges[12]. Most existing studies focus on general digitalization or financial market automation, while the specific application of AI for optimizing trading operations in commodity exchanges is still underexplored[10].

In Uzbekistan, academic literature has mainly focused on the modernization of exchange infrastructure and the development of electronic trading platforms. However, the use of artificial intelligence for real-time optimization, risk detection, and automated decision-making in commodity exchange operations has not yet been sufficiently studied[11]. Therefore, there is a clear research gap in integrating AI technologies into the optimization of trading operations at commodity exchanges. This study aims to contribute to filling this gap by analyzing the role of artificial intelligence in improving efficiency, transparency, and decision-making processes in the Commodity Exchange of the Republic of Uzbekistan[12].

Methodology

This study is based on a comprehensive methodological framework aimed at analyzing the role of artificial intelligence (AI) technologies in optimizing trading operations at the Commodity Exchange of the Republic of Uzbekistan. The research combines theoretical, empirical, and econometric approaches to ensure a systematic and evidence-based analysis[13].

The theoretical foundation of the study is built upon concepts of digital economy development, market efficiency theory, and artificial intelligence applications in financial and trading systems. In particular, the study draws on machine learning theory, big data analytics, and algorithmic decision-making models, which provide the conceptual basis for AI-driven optimization of exchange operations.

The empirical part of the research is based on the analysis of trading data from the commodity exchange, including transaction volumes, number of participants, price fluctuations, order execution time, and the frequency of unsuccessful or canceled transactions. Comparative analysis is conducted to evaluate the efficiency of trading operations before and after the introduction of AI-based technologies.

Analysis and Results

To Table 1. evaluate the effectiveness of artificial intelligence technologies in optimizing trading operations at the Commodity Exchange of the Republic of Uzbekistan, the performance of the trading system was analyzed before and after the implementation of AI-based solutions. The main indicators include operational speed, accuracy level, risk detection efficiency, and economic outcomes.

Table 1. Trading Performance Indicators (Before and After AI Implementation)[14].

Indicators	Before AI implementation	After AI implementation	Change (%)
Total number of trading operations	15,200	16,800	10,5
Average transaction execution time (min)	14,8	5,6	62,1
Share of canceled transactions (%)	12,5	7,1	43,2
Detection of pricing errors (%)	58,3	90,2	54,7
Human factor involvement (%)	82,0	38,5	53,0

The Table 2. results show that after the implementation of AI-based optimization, trading processes have significantly improved. The most notable result is the 62% reduction in transaction execution time, indicating a high level of automation and efficiency in the system.

Table 2. Performance of Artificial Intelligence Models.

Model Type	Accuracy (%)	Precision (%)	Recall (%)	F1-score (%)
Logistic Regression	80,4	78,9	77,2	78,0
Decision Tree	84,7	82,5	81,3	81,9
Random Forest	91,6	90,1	89,4	89,7
Gradient Boosting	94,2	93,0	92,1	92,5

The Table 3. results indicate that the Gradient Boosting model achieved the highest accuracy 94,2%. The Random Forest model also demonstrated strong and stable performance, making it suitable for practical application. This confirms that ensemble learning methods are the most effective for analyzing complex exchange trading data.

Table 3. Economic Efficiency Indicators.

Indicators	Before	After	Change (%)
Operational costs (billion UZS equivalent)	10,2	6,4	37,2
Share of incorrect transactions (%)	10,8	4,5	58,3
Budget savings (billion UZS equivalent)	—	15,7	—
System efficiency index (0–1 scale)	0,64	0,87	35,9

The implementation of AI technologies has significantly reduced operational costs and decreased the share of incorrect transactions by 58,3%. This demonstrates both economic efficiency and improved control mechanisms within the exchange system.[15]

Conclusion

Based on the analysis, the following conclusions can be drawn:

- trading processes have become significantly faster;
- decision-making accuracy has improved;
- risky and incorrect transactions have decreased;
- overall system transparency has increased;
- significant economic savings have been achieved.

Overall, the integration of artificial intelligence technologies has upgraded the commodity exchange system to a qualitatively new level of efficiency and performance.

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