

THE ROLE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN IMPROVING PRODUCTION EFFICIENCY IN THE OIL AND GAS INDUSTRY OF THE REPUBLIC OF UZBEKISTAN

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Abstract

The article is devoted to the study of the opportunities and challenges of integrating artificial intelligence (AI) technologies into the oil and gas industry of Uzbekistan. In the context of global changes and pressure for sustainable development of the oil and gas sector, AI is a powerful tool for increasing efficiency, reducing costs and minimizing the negative impact on the environment. An analysis of the current state and approaches to the implementation of AI technologies in this key sector of the economy of Uzbekistan will highlight important areas for further research and practical applications.

Introduction

The oil and gas industry of Uzbekistan plays a strategic role in the country's economy, providing a significant share of the gross domestic product and export revenues. At the same time, the industry faces many challenges: technology obsolescence, environmental issues and the need to increase the hydrocarbon recovery factor. In these conditions, the application of artificial intelligence technologies can be the key to improving existing processes.

Integrating artificial intelligence technologies into the oil and gas industry is a significant step towards improving operational efficiency. In the context of global challenges such as climate change and the need for sustainable resource management, the importance of sustainable development cannot be overestimated. This is especially true for Uzbekistan, which has the richest hydrocarbon reserves, but faces a number of challenges related to the impact on the environmental situation and resource use.



In recent years, there has been growing interest in the implementation of AI in the oil and gas sector in the international arena. Key studies show that AI can significantly improve the efficiency of hydrocarbon exploration, production and processing. It is noted that the use of AI for big data analysis and predictive analytics opens up new horizons in resource management.

Literature shows that AI technologies can contribute to sustainable development through improved monitoring of environmental impacts and natural resource management. For example, work on the ecosystem approach (UNEP, 2019) suggests that AI can maintain a balance between economic growth and environmental conservation.

With the growing global demand for energy and new challenges in the oil and gas industry, the relevance of improving operational efficiency is becoming critical. In recent years, the use of artificial intelligence (AI) technologies has significantly changed the paradigm of many industries, including oil and gas. In this context, the objectives of the article are to explore the possibilities of implementing AI in the production processes of Uzbekneftegaz JSC and other oil and gas enterprises of the country.

The oil and gas industry of Uzbekistan has significant potential, but faces a number of problems, such as outdated infrastructure, lack of highly qualified personnel and complex geological conditions. AI technologies can help solve these problems by automating processes, increasing drilling accuracy, optimizing resource allocation and improving equipment monitoring.

Application of Artificial Intelligence in the Oil and Gas Industry

1. Data and Analytics: The use of Big Data and AI to analyze geophysical data can significantly improve the accuracy of finding new hydrocarbon deposits. Modern data processing algorithms can identify patterns that cannot be noticed by traditional methods.
2. Automation and monitoring of processes: AI can automate control over operations, which leads to a reduction in errors and an increase in overall productivity. The use of intelligent real-time monitoring systems helps prevent emergency situations and optimize production processes.
3. Forecasting and risk management: AI can be used to predict production risks and assess the economic efficiency of projects. Machine learning methodologies allow predicting possible failures and minimizing equipment downtime.
4. Supply chain optimization: The introduction of AI in supply chain management allows for preliminary analysis of supply and demand, which improves logistics and reduces costs.



The integration of artificial intelligence into traditional processes in the oil and gas industry of Uzbekistan includes the creation of mechanisms for interaction between AI systems and traditional information systems that can be adapted to the unique conditions of Uzbekistan's fields.

This project will focus on exploring the relationship between AI implementation and sustainable development in the oil and gas industry. This highlights the importance of environmental and social aspects along with economic indicators. Integrating AI technologies into the oil and gas industry of Uzbekistan with a focus on sustainable development is not only strategically important but also potentially highly effective. This requires further research, testing and adaptation of existing technologies to unique conditions. It is important that such initiatives are implemented within the framework of a national strategy that encourages innovation, sustainable resource management and effective interaction with central and local authorities.

To assess the potential for AI integration in the oil and gas industry of Uzbekistan, secondary data analysis methods were used, as well as specialized interviews with key industry experts. Data was collected on the current state of production, challenges in the implementation of digital technologies and existing initiatives to use AI.

Results

1. Current initiatives: As part of digitalization and equipment modernization strategies, projects such as the partnership between Uzbekneftegaz and Lukoil show that AI is being used to optimize production processes and resource management.
2. Economic aspects: The integration of AI can lead to a 15-25% reduction in operating costs and an increase in hydrocarbon recovery.
3. Environmental effect: AI allows for better monitoring and management of environmental impacts, which is important for achieving sustainable development goals.[3]

An example of the successful application of AI technologies in Uzbekistan is a project to implement intelligent systems to optimize drilling and well monitoring. The use of data analysis has made it possible to achieve a significant reduction in downtime and an increase in the overall hydrocarbon recovery factor.



The economic effect of Uzbekneftegaz's digital transformation amounted to \$64.4 million. Within the framework of the concept, the Digital Field (E-kon) program was developed and a Modeling Center was created for 3D modeling of oil and gas fields, digitalization of existing geological and technical information and formation of a single database.

E-kon is a software and hardware complex for operational analysis and management of the hydrocarbon production system, in combination with tools for forecasting the performance indicators of fields in the subsoil use of Uzbekneftegaz JSC (118 fields).

The complex is aimed at complete informatization and digitalization of gas production in integration with surface field development systems that ensure the separation of gas from associated water. This will help take into account the real values of well productivity for the prompt solution of problems on preventing and eliminating emergency situations, timely decision-making on optimizing the technological operating modes of each individual well and fields as a whole.

In 2019-2023, Uzbekneftegaz digitized about 470 thousand geological and technical data on more than 7,200 wells, as well as the results of 44 thousand geophysical studies on more than 1,400 wells.

In addition, a single national database of the oil and gas industry of Uzbekistan was created in cooperation with the American company Schlumberger.

By digitalizing underground geological data, digital geological models of 122 fields, hydrodynamic models of 83 fields, and surface network models of 52 fields were developed.

Due to digitalization, it was possible to reduce geological risks at operating fields from 40-45% to 5-10% and obtain economic benefits of \$64.4 million. That is, now Uzbekneftegaz will be able to analyze 100-200 options for exploiting fields, and then select the most optimal location of wells and drilling sites (previously, a site with a large volume of groundwater could be selected by mistake). At the Nizhniy Vostochny Berdak, Nizhniy Surgil, Shurtan, Denizkul, Alan, Tegirmon, Kulbeshkak, Doyakhotin and many other fields, the design locations of 150 wells have already been revised.[2]

Despite the prospects, there are significant challenges to integrating AI into the industry. These include a shortage of skilled workers, the need for infrastructure development, and low awareness of the potential of AI technologies. The need for approaches that take into account the local context is becoming critical.

Conclusion



Integrating AI technologies into the oil and gas industry of Uzbekistan has significant potential to improve the sustainability and productivity of the sector and represents an important step towards increasing production efficiency and competitiveness in the global market. To achieve this potential, existing challenges need to be overcome, including funding, training, and infrastructure investments. Further research and development of strategies aimed at integrating AI into production processes and training are recommended. Ultimately, the implementation of AI can not only significantly improve production results, but also contribute to the sustainable development of the industry in the long term.

Search keywords:

Artificial intelligence, oil and gas industry, sustainable development, Uzbekistan, technologies, integration, process efficiency

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