UDC 553.04

A. Yu. SAFAROV[1], *Associate Professor, Candidate of Economic Sciences, Associate Professor, safariy885@mail.ru*
G. A. KHAMDAMOVA[2], *Professor, Doctor of Economic Sciences, Professor*
Sh. I. KHODJIMUKHAMEDOVA[3], *Professor, Candidate of Economic Sciences, Professor*
N. O. RAXMATULLAYEVA[4], *Associate Professor*

[1]*Oriental University, Tashkent, Uzbekistan*
[2]*Tashkent State University of Economics, Tashkent, Uzbekistan*
[3]*Tashkent Institute of Irrigation and Agricultural Mechanization Engineers–National Research University, Tashkent, Uzbekistan*
[4]*Kimyo International University in Tashkent, Tashkent, Uzbekistan*

DEVELOPMENT PATHWAYS FOR THE OIL AND GAS INDUSTRY IN UZBEKISTAN

The article is aimed at reviewing the oil and gas industry of Uzbekistan, and at analyzing the main indicators of availability, production and consumption of oil and gas. It is concluded that despite the growing demand of the population for these resources, there is a decrease in their extraction. In addition, the industry faces great difficulties in financing, and in application of new technologies and in investment. The possibility of using new technologies is presented as a case-study of digital twins, which are currently being implemented in the Russian oil and gas industry and make it possible to reduce costs and accelerate development of oil and gas fields. This solution is integrated into all task-oriented systems of control, including drilling, power supply and dynamic positioning, which together ensure that the oil platform is kept in the design position. The data are analyzed using customized sensors and the Internet of Things, artificial intelligence and machine learning, and then digital models are constructed.

It is concluded that these decisions are justified and expedient, since the economic calculation of the use of these solutions has proved their economic effectiveness.

The proposed development pathways can be used by other developing countries of the world in the future. In addition, such studies make it possible to intensify activities aimed at improving efficiency of the oil and gas sector in the Republic of Uzbekistan.

The purpose of the article is to determine the prospects for the development of the oil and gas industry in the Republic of Uzbekistan.

The article uses the system analysis, static information processing, comparative analysis, forecasting industry indicators, methods for assessing the economic effectiveness of projects, risk assessment, and others as research methods.

Keywords: *oil and gas sector, Uzbekistan, breakthrough, digitalization, solution pathways, efficiency, opportunities*
DOI: *10.17580/em.2025.01.23*

Introduction

The oil and gas industry is one of the key sectors in the world. It always draws together many activities, and its advancement is a permanent focus of growing interest in many countries. The oil and gas industry is currently enjoying development in the CIS countries. One of such countries is the Republic of Uzbekistan, where the fuel and energy sector takes a special part and supplies the country with energy and cash flows from gas export and transition.

At the same time, the oil and gas industry in Uzbekistan faces a range of obstacles connected with insufficient development and introduction of technologies which influence social and economic advancement and energy security of the Republic.

In recent years, the industry lays emphasis on introduction of renewable energy sources. Nationally, it is expected that this can greatly boost the economy and improve the quality of life in the country. However, the measures taken by the Government of the Republic of Uzbekistan to upgrade the oil and gas sector have no a tangible outcome so far, which weakens the competitive strength of the industry, and hinders high-level energy security of the country and higher living standards of its population. This is connected with some permanent and strategic problems owing to both difficult integration of the economic space of the Republic into the market economy and lack of tools of high-level strategic planning and innovation. As a result, the share of energy resources and oil decreases in the energy balance of Uzbekistan. A cease is observed in development of hydropower engineering, which affects the energy security of the Republic.

On the other hand, there is an increase in internal consumption of natural gas, coal and alternative energy sources in the country. These facts prove the disbalance in the oil and gas industry and the problems in energy management in the Republic.

The aforesaid confirms the relevance of the research to define the avenues for advancement of the oil and gas sector of Uzbekistan. In the ensuing time, these pathways may be useful for other developing countries in the world. Moreover, such research can accelerate efforts taken by the Republic of Uzbekistan to enhance efficiency of its oil and gas sector, which can transform the country from an importer to an exporter in the nearest forecast period.

This article aims to determine the growth prospects of the oil and gas industry on the Republic of Uzbekistan.

The research methods were the system analysis, statistic processing of information, comparative analysis, industrial performance prediction, evaluation of economic effectiveness of projects, risk assessment, etc.

Methods and methodology

The oil and gas industry of Uzbekistan is the key sector in the economy of the country. This fact is emphasized in scientific researches which define the status of the industry and its part in the social and economic development of the nation.

For example, Polaeva and Zhanabayev [1] describe the history of the oil and gas industry, starting from the formation of the Republic of Uzbekistan as an independent country. The industry is constructed through its cooperation around Uzbekneftegaz which is a government group of companies uniting together numerous entities engaged in recovery, processing and sales of oil and gas.

Bobokhyjaev [2] believes a signature of the oil and gas industry of Uzbekistan is its orientation at high-tech production, advanced technique, deep conversion of hydrocarbons and creation of new jobs. Furthermore, the top priorities are innovations in oil and gas processing to promote enhanced potential of the industry in the country.

Atagarrayev and Ashyrova [3] define the oil and gas industry of Uzbekistan as the largest economic sector of the crucial strategic value for the Republic although it lacks sufficient market share in the world. For another thing, the oil and gas sector of Uzbekistan has a long history, and in the modern context, it represents mostly the fuel industry, as well as extraction of gas condensate and natural gas.

Khamroeva and Safarov [4] emphasize that the value of the oil and gas industry in Uzbekistan is governed by a huge number of investment projects

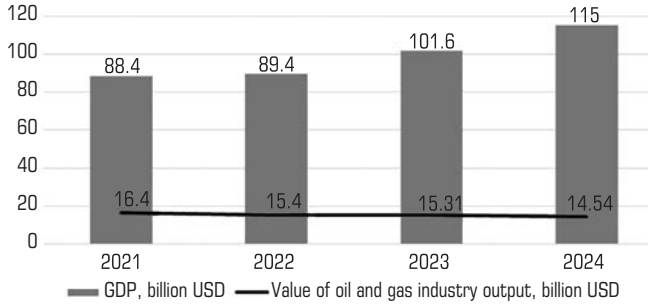

Fig. 1. GDP and oil and gas share in the Republic of Uzbekistan [8]

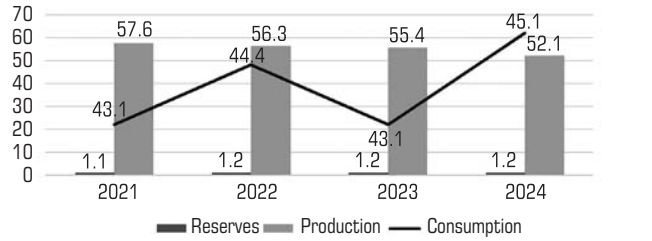

Fig. 2. Uzbekistan's gas sector: key performance indicators, trillion m^3 [8]

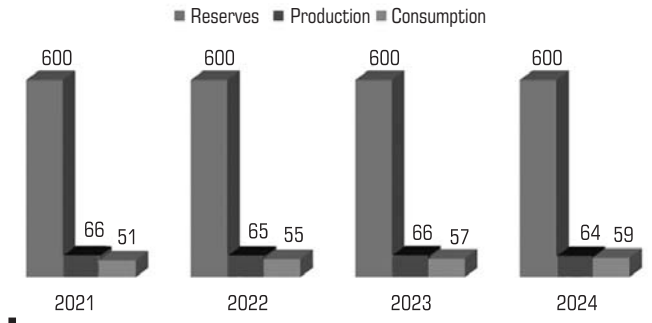

Fig. 3. Key performance indicators of oil sector in Uzbekistan, million barrels [8]

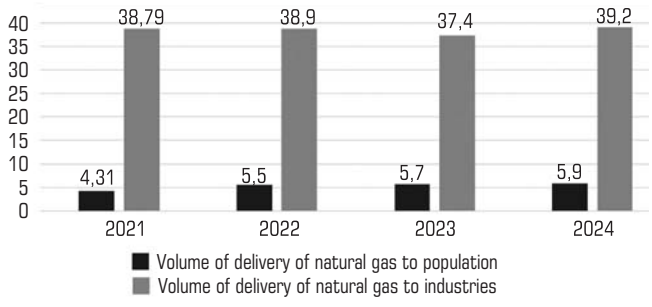

Fig. 4. Dynamics of domestic consumption of gas in Uzbekistan, billion m^3 [10]

and their implementation aimed at modernization of the national economy, maintenance of competitive ability of the industry, as well as at attraction of foreign investment in efficient R&D and in advancement of the oil and gas sector of economy in Uzbekistan.

Potravny et al. [5] also prove the influence exerted on the national economy by its oil and gas sector. The authors display the influences on the efficiency of oil and gas projects, including political, social, economic, geological, ecological and climatic factors, and define their role on the micro- and macroscales.

For minimizing and neutralizing ecological aftermath, the Republic can use burial technologies to keep greenhouse gas in mined-out underground geological spaces or underground storages [6]. For the efficiency evaluation of oil and gas projects, the authors propose an integrated criterion uniting the criterion of economic efficiency (investment profitability) and the criterion of scheduled accomplishment of projects. In addition, it is found how the oil and gas industry performance is connected with the climatic change and greenhouse gas emissions.

Performance of the oil and gas industry involves the risk of accidental pollution of soil with petroleum derivatives, which requires development and application of reclamation technologies, and this should be taken into account in digital twin design for the oil and gas companies [7].

The aforesaid proves the economic significance of the oil and gas industry, and its contribution in the GPD and in the overall social and economic development of the country. **Figure 1** illustrates the actual input of the industry in the national economy in terms of the dynamics of the Republic's GDP and the share of the oil and gas sector in it.

Despite the increment in the overall country's GDP, the volume of production decreases in the oil and gas sector, which points at the certain problems in it. This is connected with the reduction in oil and gas recovery, and with the slow-down of development of oil and gas fields though holding sufficient reserves. **Figure 2** depicts the dynamics of the gas sector, with the specified reserves and volumes of production and consumption. It is seen that the production decreases while the consumption grows. That became the reason for gas import in 2024.

Although public factories and foreign companies actively operate in the oil and gas sector of Uzbekistan, gas production experiences a decrease in recent years. The top foreign companies to invest in the energy sector of the country are LUKOIL, GAZPROM and Chinese CNPC. Regarding the oil sector, its proven oil reserves total 600 million barrels. The daily oil recovery reaches 62 million barrels. Unfortunately, in the recent decade, the industry faces a decrease in oil recovery, which is connected with the depletion of oil reservoirs and with the lack of sufficient resources and investment.

Figure 3 demonstrates the dynamics of the oil sector of Uzbekistan.

It is seen that the oil production and consumption reduce, which is also connected with the system problems in the Republic, and with the deficient investment in technological development and in the industry as a whole. Irrespectively, the progress in the oil sector is underway. New technologies are introduced, and new manufacturing is launched [9]. The industry effects cooperation with foreign investors that enable upgrading of the sector and bolstering transportation system capacity.

An important pathway of development is scaling up delivery of natural gas to the population. The delivery dynamics is shown in **Fig. 4**.

It is seen in Fig. 4 that the volume of natural gas deliveries grows inside the country owing to the enhancement of gas transportation system capacity thanks to construction of new gas mains and the required infrastructure [6]. At the same time, the volume of export of natural gas drifts down due to the growing demand inside the country. This preconditions an increase in the import of oil and gas.

Results and discussion

At the present time, the industry has to deal with a lot of problems. They are mostly connected with insufficient energy supply. The causes of this is the depletion of mineral deposits and the population upsurge, while the latter inspires business development and stimulates growth of oil and gas demand.

In 2023 gas production decreased from 70 to 46 billion cubic meters and oil production dropped from 8 million tons to 0.77 million tons per year. Apart from mineral depletion, development of new fields lacks investment [11].

Geological explorations experience little attention in Uzbekistan. In this regard, it is required to attract investment in the industry and to introduce modern technologies in geological exploration of 15 promising subsoil areas [12].

Russian investors vividly interact with the oil and gas industry of Uzbekistan. The projects in progress are described in **Table 1** [13].

The other projects in progress are aimed at expansion of the investment cooperation between countries in the sector of mineral mining. However,

development of oil and gas fields experiences a formidable advance because of insufficient finance and investment.

For this reason, it is advisable that the Uzbek oil and gas sector attempts cutting down expenses connected with geological exploration. To this effect, it is necessary to introduce new technologies to speed up processes and to enhance their productivity [14].

It is possible to advert to the experience gained by ROSNEFT and to introduce digital technologies in exploration, including digital twins. This is a very promising way, and allows reduction of costs and performance time.

Intrinsically, digital twins of a mineral deposit are the digital models of rock columns extracted from holes during geological exploration for the assessment of rock composition and nature of an oil/gas reservoir [11]. The lab-scale core analysis is a complex and expensive process. Cores often disintegrate in the course of recovery and testing, which elevates the total mining cost.

This solution is integrated in all task-oriented systems of control, including drilling, power supply and dynamic positioning, which together ensure that an oil platform is kept in the design position [15]. The data are analyzed using customized sensors and control systems with help of the Internet of Things, artificial knowledge and machine learning, and digital model are built then and sent to a predictive analytics center.

Experience gained by ROSNEFT in application of digital twins in exploration showed the decrease in operational costs by 20% and the enhanced quality of drilling. Digital twins revealed many anomalies and warned on possible faults of equipment. The review of the use of digital twins by the top oil companies of the world made it possible to systematize effects of the approach. These effects are compiled in **Table 2**.

The reported data prove the efficiency of digital twins in mineral mining in Uzbekistan; their introduction allows reduction of mining cost by 40% on the average. The expected cost cutting of project implementation can attract investors in the industry [16].

The influence of digital twins on business processes in exploration of oil and gas reservoirs is generalized in **Table 3**.

Table 1. Projects in implementation by Russian investors and oil and gas companies of Uzbekistan in 2024 [13]

Parties	Deed	Goal	Performance
Russian Export Center JSC, VEB.RF, Jizzakh Petroleum LLC	Agreement on interaction	Increasing oil production and hydrocarbon processing in Uzbekistan	Delivery of Russian oil and gas equipment, pipes and special equipment; financing through the Russian Export Center
Russian Export Center JSC, Uztransgaz JSC	Memorandum of understanding	Export maintenance in the sphere of manufacturing of pipes and oil and gas equipment within the framework of modernization of gas transportation system	Large-scale investment; participation of the Russian Export Center in financing; top-priority project for the Uzbekistan Government
Russian Export Center JSC, Chelyabinsk Pipe Rolling Plant, Eriell Group	Memorandum of intent	Financial and technological cooperation in manufacturing and delivery of pipes and oil and gas equipment	Delivery of products of the Chelyabinsk Pipe Rolling Plant; supportive measures from the Russian Export center; oil and gas pipe line construction projects and exploration projects

Table 2. Effects of digital twins (DT) in oil and gas industry [12]

Oil company	Description	Cost	Economic effect, %
TMK	Hot rolling mill DT	500 million rubles in 2 years	145
CNH Industrial	Processing line DT—truck chassis welding	No information	48
YPF	DT of borehole equipment	18 million USD per year	49
PNTZ	DT of a pipe rolling workshop area	↓ 45%	142
Centrotherm Photovoltaics AG	Processing line DT	920 thousand USD per year	38
KAMAZ	NC machine DT	50 million rubles from introduction, further forecast is 100 million rubles	39
EVRAZ	Steel production process DT	160 million rubles per year	39
Petropiar	DT of equipment at a production facility	No information	137
Magnelec	DT of boiler metering system	920 thousand USD per year	40
NEVZ Plant	DT of more than 300 machines	No information	41
CIMC	Energy equipment DT	No information	39
Average			42

Table 3. Influence of digital twins on business processes in oil and gas exploration in Uzbekistan [17–19]

Area of application	Objective	Effect
Process flow	Reduction of geological exploration period	Reduction of drilling time by 20%
Technical operations control	Improvement of equipment reliability	Real-time monitoring of drilling equipment
Maintenance	Enhanced efficient of capital and operating expenditures (CAPEX/OPEX)	Reduced cost of operation of drilling rigs by 25%
Capital construction	Automated control of implementation of investment programs	Monitoring of implementation of geological exploration projects
	Reduction of capital expenditures (CAPEX)	Cost saving by 10% owing to optimized planning and design
Personnel skills and expertise management	Improvement of personnel skills	Increased productivity by 30% after introduction of new technologies
	Improvement of personnel safety	Reduction in accidents by 25% owing to improved personnel training and management
Production resources management	Automated calculation of availability index and deviations	Monitoring of technical condition of drilling equipment
	Digital life cycle of equipment	Creation of digital profiles for each drilling module with regard to its condition and operation experience
	Automated scheduling of maintenance and repair	Optimization of maintenance plans based on the analysis of information of equipment condition

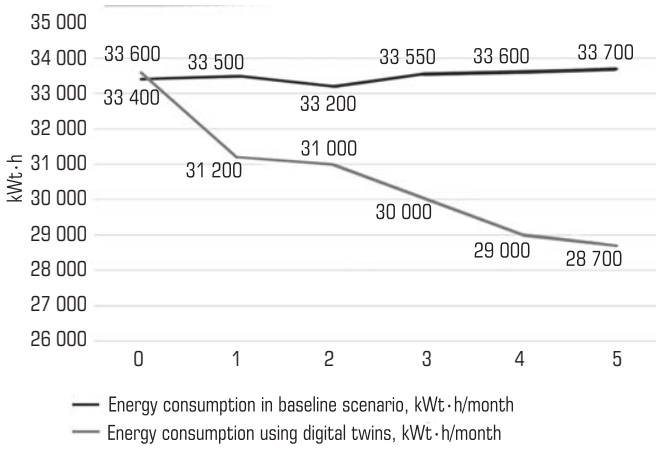

Fig. 5. Energy consumption using digital twins and in baseline scenario (calculated by the authors from the data of ROSNEFT's corporate report)

On evidence of ROSNEFT, the digital twin introduction in mechanical recovery of oil promoted appreciable cost saving. For example, curtailing of energy consumption using the digital model is illustrated in **Fig. 5** [20].

It is seen that using digital twins, energy consumption is initially rather high. Then, it greatly lowers in the next 5 months. On the whole, the savings of the project totaled 500 thousand rubles per month and 6 million rubles per year.

The economic effect calculation proves the expediency of introduction of this solution as it ensures cost reduction as early as the first year of application, which provides additional income.

Large-scale introduction of digital twins in geological exploration and in oil and gas recovery in Uzbekistan can enable cost saving in this mineral sector [21]. This will enhance investment attractiveness of the Uzbek oil and gas companies for the foreign investment, encourage inward investment and promote development of the oil and gas sector of the Republic [22]. Yet, it is necessary to scrutinize all effects of introduction of new solutions, including risks, ecologicity and social outcomes.

Conclusions

The article presents the analysis of the oil and gas industry of Uzbekistan, which currently experiences some difficulties: reduction of oil and gas production despite the growing internal demand. This is connected with the deficiency of finance and investment which could help optimize exploration and production processes and, thus, greatly reduce the associated expenditures. Accordingly, it is proposed to use experience of Russian companies and introduce digital technologies at the oil and gas companies in Uzbekistan to construct a maximally effective and workable mechanism of oil and gas exploration and recovery.

At the same time, this will promote development of new deposits and increase of production volume. The presented example demonstrates efficiency of digital technologies, which proves their validity and adaptability to different processes, deposits and companies.

Reference

1. Polaeva G. B., Zhanabayev A. A. The current state and prospects for the development of the oil and gas complex of the Republic of Uzbekistan. *Innovation & Investment*. 2022. No. 8. pp. 4–7.
2. Bobokhujaev Sh. I. Problems and modern approaches to modification of corporate management in oil and gas companies in Uzbekistan. *Upravleniye predpriyatiyem*. 2015. No. 9. pp. 54–60.
3. Atagarrayev T., Ashyrova B. Oil and gas industry of Central Asia—Main factor of economic development. *Science Bulletin*. 2025. Vol. 3, No. 1(82). pp. 1201–1208.
4. Khamroeva I. N., Safarov G. A. Sustainable development of the oil and gas industry in the Republic of Uzbekistan and introduction of the advanced technologies is the basis of its investment attractiveness. *Problems of economics and management of oil and gas complex*. 2017. No. 7. pp. 36–41.
5. Potravny I. M., Novoselov A. L., Novoselova I. Yu., Pelmeneva A. A. Factor analysis of oil and gas projects in the Arctic areas with regard to risk. *Gornyi Zhurnal*. 2023. No. 12. pp. 64–68.
6. Potravny I. M., Yashalova N. N. Ecologo-economic assessment of burial technologies for greenhouse gas emissions in underground geological spaces. *Gornyi Zhurnal*. 2022. No. 8. pp. 90–94.
7. Apulu O. G., Potravny I. M., Sukhorukova I. V. Methods of justification and selection of technologies for remediation of oil-contaminated land. *Ecology and Industry of Russia*. 2021. Vol. 25, No. 6. pp. 38–43.
8. Available at: https://stat.uz/ru (accessed: 20.03.2025).
9. Dadakhodzhayev A. T., Mannanov U. V., Ashmukhamedov M. A. Oil and gas industry of Uzbekistan. *Oil and Gas Chemistry-2024: Proceedings of VII International Forum on Chemical Technologies and Oil and Gas Processing*. Minsk : BGTU, 2024. pp. 48–53.
10. Available at: https://statbase.ru/data/uzb-gas-consumption/ (accessed: 20.03.2025).
11. Usmanov Z. K., Murtozayeva D. B. Issues of enhancing efficiency of gas transportation system in Uzbekistan. *New Technologies for Oil and Gas Region: International Conference Proceedings*. Tumen : Tumenskiy Industrialniy Universitet, 2016. Vol. 1. pp. 380–383.
12. Gabidullin I. R., Fedorov S. N. Application of digital twins in the oil and gas industry. *Aktualnye issledovaniya*. 2025. Vol. 25.
13. REC supported projects in the oil and gas industry of Uzbekistan. Available at: https://www.exportcenter.ru/press_center/rets-podderzhalproekty-neftegazovoy-otrasli-uzbekistana-/ (accessed: 20.03.2025).
14. Muratov A. S., Mallaev S. A., Gulamov R. A. et al. Digital solutions to increase gas production in Western Uzbekistan. *Universum: tekhnicheskiye nauki*. 2024. No. 9 (126). Available at: https://7universum.com/ru/tech/archive/item/18180 (accessed: 10.03.2025).
15. Abdullaev G. S., Bogdanov A. N., Eydelnant N. K. Current state and development prospects of geological exploration activity for oil and gas in the Fergana Region of the Republic of Uzbekistan. *Neftegasovaya geologiya. Teoriya i praktika*. 2021. Vol. 16, No. 2. Available at: https://ngtp.ru/upload/iblock/11f/15_2021.pdf (accessed: 10.03.2025).
16. Rasulova N. N., Hamrayeva Sh. K. Strategy for the Development of the Oil and Gas Sector during the Transition to a Green Economy in Uzbekistan. *Current problems and prospects of the oil and gas industry*. 2024. pp. 454–458.
17. Bykova V. N., Kim E., Gadzhialiev M. R. Application of a digital twin in the oil and gas industry. *Actual Problems of Oil and Gas*. 2020. Iss. 1(28). DOI: 10.29222/ipng.2078-5712.2020-28.art8
18. Bobokhujaev Sh. I. Modern approaches to problem solving in corporate management and to modification of oil and gas companies in Uzbekistan. *Upravleniye predpriyatiyem*. 2015. No. 9. pp. 15–21.
19. Samiyev S. I. Current state of investment activity of oil and gas companies of Uzbekistan and its specific tendencies. *Economics and Finance*. 2022. No. 2. pp. 10–18.
20. Chorieva M. M., Nigmatova F. U., Mansurova M. A., Sultonova F. U. Development of a rational package of materials overalls for oil production workers. *Modern Innovations, Systems and Technologies*. 2022. Vol. 2, No. 2. pp. 310–400.
21. Khamroeva I. N., Nabiev Sh. T., Pak S. A. Comparative analysis of reporting disclosures and preparation for transformation of NAS into IFRS. *Academic Journal of Digital Economics and Stability*. 2021. pp. 244–254. DOI: 10.51699/ajdes.vi.174
22. Karimov M., Khamroeva I., Ivonina I. Improvement of management of sustainable development of oil and gas industry of Uzbekistan. *International Journal of Innovations in Engineering Research and Technology*. 2020. Vol. 7, No. 5. pp. 102–112. EM