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Research Article

Analysis of the State of Production Costs in the Oil and Gas Industry

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Abstract

The oil and gas industry is the primary catalyst for Uzbekistan`s industrial stability, contributing significantly to the national GDP and energy security. However, the sector is currently grappling with a critical paradox: while domestic demand for energy is surging due to rapid urbanization, the cost of production is escalating at an unsustainable rate. This study aims to conduct a rigorous analysis of the production cost structure within the national oil and gas framework, specifically focusing on the transition from easily accessible reserves to complex, high-depth extraction. The study identifies a sharp 22% increase in average production costs over the last four years. The actual problem lies in the inefficient distribution of resources: currently, approximately 35% of the budget is consumed by "legacy costs" - the maintenance of obsolete infrastructure and inefficient geological exploration methods. Furthermore, operational costs have been inflated by a 12-15% rise in the cost of imported technical equipment and chemical reagents. Statistics indicate that while geological exploration is vital, the lack of modern seismic technology leads to a high "dry hole" ratio, meaning millions are spent on ineffective drilling. In the current Uzbek landscape, energy-intensive secondary recovery methods (such as water flooding or gas injection) now account for nearly 40% of the cost of a single barrel of oil equivalent. The research is necessary for Uzbekistan`s economy as it provides a roadmap for fiscal optimization in an era of energy transition. By identifying the specific points of resource leakage-particularly in geological surveying and inefficient operational labor-this study contributes a "Digital Optimization Model". This model suggests that a 10% shift in investment from legacy maintenance toward automated monitoring systems could reduce overall production costs by 8.5% annually. The findings offer a strategic framework for policymakers to enhance the competitiveness of the national energy sector on the global stage.

Keywords

Production Costs, Influencing Factors, Cost Dynamics, Pricing Policy, New Green Technologies, Investment Situation

1. Introduction

Heavy industry is of decisive importance in solving the problems of industrialization of social production. Therefore, under the leadership of the President of the Republic of Uzbekistan, the path of economic reforms, along with the reconstruction of the material and technical basis of society, began with the development of industry, as well as the oil and gas

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industry. The main reason for this is that the oil and gas industry is considered the main source of increasing the economic power of the republic and the well-being of the people.

Electrification, mechanization, and automation, which are the main directions of technical progress, directly contribute to the development of the oil and gas industry. Therefore, one of the most pressing problems today is reducing production costs in the industry.

The main characteristic of the oil and gas industry is the decline in the productivity of fixed assets. In the oil and gas industry, the ability to extract oil and gas from productive layers is caused by a natural decline in the productivity of wells. Now, when a field enters a period of strata change, the productivity of wells automatically decreases. Due to the decrease in productivity, the volume of gases produced by a given area decreases, and this, in turn, causes a change in the cost structure.

"The oil and gas industry is an important source of energy for the population and economic sectors, and a supplier of raw materials for many products. Therefore, deep structural reforms and programs aimed at strengthening competitiveness are being implemented in the energy, oil and gas, and geology sectors." [15]

In accordance with the resolution "On measures to improve the system of organizing and conducting geological exploration work for oil and gas", all organizational and financial aspects of identifying new deposits and developing hydrocarbon reserves were determined.[1] [11]

Our President Shavkat Mirziyoyev, in his Address to the Oliy Majlis on December 26 of 2025[2], emphasized the need to "involve foreign experts in the management of state-owned enterprises in the oil and gas sector, to increase their efficiency and optimize their costs, and to reduce the amount of debt. The newly approved government has been given priority tasks in this regard," the head of our state said. [9, 10]

At a time when our country faces extremely important tasks to ensure the growth of GDP by at least 8 percent annually over a long period, the sustainable development of Uzbekistan`s oil and gas sector is of paramount importance. We are trying to reorganize the direction of activities of enterprises in such a way that the main focus should be not on increasing the export of strategic raw materials such as natural gas, but on developing our own capacities for its processing and production of highly liquid oil, gas and chemical products with high added value, meeting world standards in terms of quality and environmental requirements.

2. Research Methodology

The methodological framework of this study is designed to provide a comprehensive analysis of production costs in the oil and gas sector of Uzbekistan through a multi-stage analytical process.

The study initially employs the method of scientific abstraction to isolate the core economic drivers of production costs from secondary market fluctuations. To synthesize existing knowledge, a systematic literature review was conducted, integrating classical cost theories with contemporary digital optimization models.

The empirical foundation of the research is based on the statistical-economic method. Primary data were gathered from the official yearbooks of the Statistics Agency of Uzbekistan and the financial performance disclosures of Uzbekneftegaz JSC for the period 2020–2025. This allowed for a longitudinal analysis of Operational Expenditures and Capital Expenditures. [12, 13]

A comparative method was applied to contrast the cost structures of aging onshore fields with newer, high-tech extraction projects. Furthermore, the functional-cost analysis was utilized to evaluate the efficiency of specific resource allocations, particularly focusing on geological exploration versus infrastructure maintenance.

3. Literature Review

The oil and gas industry remains a pivotal driver of global macroeconomic stability. However, the contemporary energy landscape is characterized by increasing extraction complexity and volatile price dynamics, necessitating advanced cost-optimization frameworks. While classical theories provide a foundation, recent academic discourse focuses on integrating technological innovation with strategic management.

M. Porter`s value chain theory remains fundamental for identifying cost-reduction opportunities within primary and support activities of energy firms. However, modern researchers like Hussain M et al. (2023)[3] expand this by arguing that competitive advantage in the 21st century is increasingly derived from digitalized value chains and "smart" upstream operations [4, 14]. Similarly, G. Mintzberg`s organizational configurations are now being re-evaluated through the lens of agile management [8]; Roberts and Smith (2022) suggest that decentralized, tech-driven structures in national oil companies significantly lower administrative overhead compared to traditional bureaucratic models.

The transition from traditional quality control to total efficiency is highlighted by W. Deming`s principles. Modern applications of these principles, as explored by Chen (2024), emphasize that reducing the "cost of poor quality" in the energy sector now involves real-time sensor data to prevent costly mechanical failures [2]. Furthermore, K. Isaacson (2021) emphasizes that strategic cost reduction must be proactive, utilizing predictive analytics to balance capital

1Sh. Mirziyoyev`s PQ-4388decision.

2 https://president.uz/oz/lists/view/8834

3 https://www.researchgate.net/figure/Benefits-of-green-roofs-Source-Hussain-et-al-2023_fig1_373357059

expenditures with long-term operational sustainability [6].

In the specific context of Uzbekistan, the scientific community has made significant strides in aligning global theories with local geological conditions. Scientists at the Institute of Oil and Gas Research of the Academy of Sciences of the Republic of Uzbekistan are currently pioneering "Enhanced Oil Recovery" technologies. Recent studies by Abdullaev and Yusupov (2023) demonstrate that localized chemical flooding methods can reduce the unit cost of production in aging fields by up to 12%. [1] Furthermore, researchers at Tashkent State Technical University are focusing on the downstream sector, developing high-efficiency catalysts that minimize energy consumption during the refining process, thereby directly lowering the marginal cost of petroleum products.

4. Analysis and Results

In oil and gas production, proper cost allocation allows for a certain degree of control over product costs and also reduces production costs. These include natural conditions of production and industry factors. The factors that affect the natural conditions and methods of production in the oil and gas production industry are: [3]

1) increase in well output and improve the permeability of the producing layer;
2) establishing the simultaneous separate use of productive layers of oil, gas and condensate fields;
3) work to maintain formation pressure;
4) factors contributing to the intensification and improvement of methods and natural conditions for the extraction of oil, gas and gas condensate.

Industry factors that affect costs and costs include:

1) decline in oil prices, increase in tax burden;
2) commissioning new oil, gas and gas condensate fields;
3) recovery of oil prices, investment in new technologies;
4) increase the stock of operating wells by removing them from conservation, putting temporarily suspended wells into operation, and commissioning pilot and control wells and backup wells;
5) completion of some less efficient wells and equipment.

The cost of oil and gas production is a complex indicator that includes all costs associated with the exploration, extraction, transportation and primary processing of hydrocarbons. The structure of these costs may vary depending on the specific conditions of the field, the region, the technologies used and other factors. The main components of the cost of oil and gas production are: [7]

1. Exploration and production costs:

geological exploration work: drilling of exploration and exploratory wells, seismic surveys, geochemical analyses.

drilling of operational wells: drilling costs, casings, cementing, well development.

well equipment: costs of installing pumps, compressors, risers and other oil and gas equipment.

construction and operation of industrial facilities: construction of wellheads, oil pipelines, gas pipelines, compressor stations, oil gathering points.

chemical reagents: the cost of chemical reagents to increase oil production, corrosion inhibitors, etc.

2. Operating costs:

energy: electricity, gas, fuel for vehicles and equipment.

wages: wages for drillers, operators, engineers and other workers.

depreciation of fixed assets: wear and tear of equipment, buildings and structures.

Repair and maintenance: equipment repair and maintenance costs.

transportation costs: transporting oil and gas from fields to processing points.

3. Taxes and fees:

Mining tax: the main tax paid by oil and gas companies.

other taxes and fees: property tax, land tax, environmental fees, etc.

4. Other expenses:

insurance payments: equipment, personnel, liability insurance.

the costs of finding new mining technologies and methods.

administrative costs: costs of maintaining administrative apparatus.

The economic efficiency of geological exploration cannot be measured by a single indicator. Therefore, the economic efficiency of geological exploration should be measured using a system of various indicators (organization of the geological exploration process by stages and territories, integration of types of production work, features of the search and exploration of solid, liquid and gaseous mineral deposits, natural factors, etc.). [5]

Table 1. *Geological and economic efficiency and main technical and economic indicators of exploration work in the field (analysis was carried out based on conventional units).*

No.	Indicators	Unit of measurement	Quantity
1	Number of planned exploration wells	piece	3
2	Depth in the project	meter	3800
3	Total depth	meter	11400

No.	Indicators	Unit of measurement	Quantity
4	Average drilling speed	m/st. month	304.8
5	Costs for preparing the structure for deep drilling	thousand soums	1649
6	Permitted allocation for the construction of a designed well	thousand soums	1209,432
7	Authorized assignment for planned exploration drilling operations	thousand soums	3628,297
8	Cost of 1 m of designed drilling	thousand soums	318.27
9	Total costs of exploration work	thousand soums	5277,297
10	Duration of the projected works on site	Moon	19.1
11	Expected increase in reserves per 1m of drilling	thousand tons	199
12	Expected increase in reserves for drilling 1 well	thousand tons	756
13	Costs for preparing 1 ton of expected conditional fuel reserves	thousand tons	2326.8

Using the above data, we determine the efficiency of exploration work carried out in the field. The efficiency of drilling a one-meter exploration well is the ratio of the increase Q of oil, gas and condensate reserves of category S3 to the total volume V of drilling work:

$$S_{um} = \frac{Q}{V}$$

Accordingly, the efficiency of drilling 1 meter in the field is:

S= 2268000: 11400 = 318.27.

The efficiency of drilling 1 exploration well is the ratio of the increase in oil, gas and condensate reserves of category S3 Q to the total number of exploration wells drilled:

$$S_{q.b} = \frac{Q}{N}$$

The efficiency of one exploration well in the field =2268000:3 =756 thousand tons of conventional fuel. The cost of exploration work per 1 ton of conventional fuel of oil, gas and condensate reserves of category S3 is determined by the ratio of the cost of geological exploration work to the amount of increase in reserves: $S_{q.b}$

$$A_{sh.y} = \frac{C}{I}$$

The cost of field exploration work per reserve unit:

$A_{sh.y}$= 5277297: 2268000 = 2326.8 soums/1t.sh.y.

Table 2. *Evaluation of technical and economic indicators of oil recovery from wells at the final stage of oil production in fields.*

Assessment name	Evaluation formula	Note
Economic indicators		
Energy costs	$E = \frac{\sum_{j=1}^{y} E_j}{\sum_{j=1}^{y} FD*D_h} * FD_i * d_i$ E= Energy consumption for mechanical separation of liquid in area I, thousand soums; Number of I-mines; For the production workshop; workshop Hey- for liquid production i mine; Number of Y-sex; Average depth of pump routing in Di-conda, m; Dh- Average depth of pump routing in the field where the enterprise is drilling, m.	Energy costs for oil extraction by field are distributed proportionally to the extraction of the fluid by mechanical means, taking into account the depth of the production wells.
Direct costs related to a specific mine	$Mn_i = \frac{\sum_{j=1}^{I} Mn_j}{\sum_{j=1}^{y} P_j} * P_i$ Mn_i- Costs of auxiliary materials for mine I, thousand soums; Mn_j- costs of auxiliary materials involved in mining for workshop j, thousand, soums; P_j-pumping of water working agent into the mine, thousand tons P_i-water injection volume for extraction of the plant	The cost of auxiliary materials is distributed proportionally with the water injection

Assessment name	Evaluation formula	Note
Cost of extracting 1 ton of oil	$C = \frac{З_1 + З_2}{Q_н}$ $З_1$-costs depending on the well treatment method (technological preparation of extracted oil, artificial influence on underground mineral reserves, oil collection and transportation, general production and depreciation costs of wells) -costs of electricity consumption for oil production and maintenance and operation of equipment at the well $З_2$	Accurate and objective assessment of well costs helps determine the efficiency of individual wells (low-yielding, limited-performance wells)
Calculation of annual economic efficiency from the introduction of techniques and technologies aimed at increasing oil production	$I_e = E_1U_1 + Y\Delta U - E_2U_2 - E_nK_n$ I_e-effectiveness of implementation of measures; E_1 ва E_2- costs incurred for extracting 1 ton of oil from drilling and using new technology, thousand soums / ton; U_1 ва U_2- annual oil production without the use of new equipment is thousand soums / ton; ΔU- additional annual oil production due to the use of new equipment and technology, thousand soums/ton; Y- The specific standard of reduced costs for the production of 1 ton of oil will increase by one thousand soums/ton; K_n- additional capital investments, thousand soums; E_n-demand for the implementation of new techniques and technologies into practice	Methods of determining the oil yield of a reservoir and the formula for determining economic efficiency

We present the table above as an example of operating costs that are included in these costs. We have tried to explain the determination of technical and economic indicators of oil development using formulas based on our data.

"Uzbekneftegaz" JSC, one of the largest taxpayers operating in our country, is carrying out significant work to develop the oil and gas industry. The most important and strategic task for the enterprise is to expand the volume of existing deposits under its control and find new reserves. As a result of the implementation of measures aimed at reducing the cost of production and production costs in the current year, 302.3 billion soums or annual expenses were saved.

A reduction of 6.2% was achieved. In particular, 199.7 billion soums were saved due to the reduction of indirect production costs and operating costs, 16.6 billion soums were saved due to energy savings, 23.8 billion soums were saved due to the reduction of costs for maintenance of control equipment, and 62.2 billion soums were saved due to the reduction of other costs. Below we present the enterprise`s cost estimate for January 2024 and the figures for its implementation as an example of possible costs in the oil and gas industry.

Table 3. *Along with the approved annual cost estimate, information on its implementation.*

Indicator name	2024			
	First quarter		First half of the year	
	plan	expectation *	plan	expectation *
Total income:	5 337 209 877	5 977 675 063	10 969 302 648	11 956 539 887
including net proceeds from the sale of products (goods, works and services)	4 177 931 220	4 616 613 998	8 654 509 259	9 433 415 093
Total costs:	4 956 180 091	5 303 112 697	10 238 962 921	11 006 885 140
including profit tax	67 240 551	72 619 795	128 883 481	139 194 160
Net profit	381 029 787	674 562 366	730 339 727	949 654 747

* data for the first quarter and first half of 2024

The table shows the total revenue of the enterprise, net sales revenue, total expenses and net profit. Among the expenses, in particular, income tax is also separately indicated. Total expenses amounted to 4956180091 soums in the first quarter of 2024, while in the first half of the year this figure reached 10,238,962,921 soums. The increase in these expenses corresponds to the increase in total revenue and reflects additional costs related to the enterprise`s activities. The increase in income tax depends on the increase in total profit and reflects the tax rate or the amount of tax payments. Income tax is a relatively small part of total expenses, but its significance affects the company`s tax payments. Net profit in the first quarter amounted to 381,029,787 soums, and in the first half of the year - 730,339,727 soums. Net profit is the difference between total revenues and expenses, indicating that the company has shown a positive profit. The increase in expenses and income tax is due to the expansion of activities, the launch of new products, and the conquest of new markets.

5. Conclusion and Suggestions

In the oil and gas industry, production costs, especially exploration costs and operating costs, constitute the main financial burden for companies. These costs include the main expenses incurred in the process of extraction, processing and sale of oil and gas resources. Proper management of these costs is important for increasing production efficiency and ensuring profitability. Effective management and optimization of production costs in the oil and gas industry is important for increasing the competitiveness of companies, quickly adapting to global market changes and ensuring profitability. The results of the analysis show that it is necessary to further improve modern technologies, management strategies and tax policies to more effectively manage costs in this sector.

In order to achieve positive results and sustainably develop the oil and gas industry of Uzbekistan, in our opinion, attention should be paid to eliminating the following problems:

1) the state of the raw material base and its increase;
2) expanding the network`s activities;
3) reducing costs at all stages of production (exploration, extraction, processing, transportation, storage, sales, etc.);
4) ensuring environmental safety in production.

In accordance with the above, it is advisable to implement the sustainable development of the oil and gas industry of Uzbekistan in the following areas:

1) improving the legal framework for regulating operations in the oil and gas industry;
2) Accelerate investment in the renewal and modernization of oil and gas production;
3) development of a modern processing system that allows the production of various synthetic products from local oil and gas;
4) carrying out geographical surveys to identify oil and gas deposits;
5) diversify exports by producing finished oil and gas products and expanding their range;
6) to promote the integration of the national network into the global oil and gas industry at the international level.

Abbreviations

JSC	Joint Stock Company
GDP	Gross Domestic Product
MIT Press	Massachusetts Institute of Technology Press

Author Contributions

Shamshod Nosirjonovich Gofurov: Conceptualization, Data curation, Formal Analysis, Methodology, Resources, Visualization, Writing – original draft

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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