

TECHNICAL SCIENCES

RISK FACTOR IN ECONOMIC FORMATION FOR DEVELOPMENT OF OIL AND GAS RESOURCES (ON THE EXAMPLE OF AZERBAIJAN)

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<https://doi.org/10.5281/zenodo.14870604>

Abstract

The article describes that developed countries such as Norway and the United States annually receive hundreds of billions of US dollars in the development of oil and gas resources due to the maintenance of the existing scientific and technical potential, the constant development of infrastructure and economic mechanisms, the use of accumulated national and world experience, and the implementation of commercially attractive projects. The development of the oil and gas sector is considered from the point of view of the general technological process, taking into account the market for high-tech products and services related to oil and gas operations. It is proposed to mobilize the existing scientific and technical potential of the republic and invest in the implementation of advanced technologies for the production of competitive products and their sale on world markets. The article describes the ways of modernization and development of an innovation-oriented approach to the development of hydrocarbon resources both on land and at sea, ways to solve existing and prospective problems in this area based on a comprehensive transformation of the technical system and economic mechanism.

Keywords: oil and gas, growth of reserves, development, investment, innovation, scientific and technological progress, oil sector

I. Introduction

On a global scale, in the context of continuous deterioration in the quality of the resource base of the oil and gas production industry and minimal increases in oil reserves due to exploration work, as well as the non-replenishing volumes of production, increasing oil recovery is acquiring strategic importance for stabilizing oil production and fostering its growth.

In the 21st century, science has become a powerful productive force, and scientific and technical potential is a determining factor in the competitive struggle of countries in the world market. National power increasingly depends on knowledge, science-intensive activities, and high technologies.

The practice of developed countries in developing oil and gas fields shows that the growth of oil recovery depends on the substantiation of operational facilities. Today, in industrially developed countries, 70 to 90% of GDP growth is achieved through the use of scientific research and development, i.e., through innovation. The main purpose of innovation policy today is to preserve accumulated scientific and technical potential while developing the infrastructure and economic mechanisms that launch innovation processes. Worldwide, the state plays a decisive role in creating innovation infrastructure. Financial resources invested in infrastructure are returned through increased employment and higher tax collection. Additionally, a layer of entrepreneurs oriented toward high-tech business is emerging.

The role of the state in the development of oil and gas resources is significant not only in oil-producing countries of the third world but also in industrially

developed countries such as the USA, Canada, Great Britain, Norway, and Australia. Over the past decades, the state's focus on the innovative aspects of the oil and gas sector has increased significantly. This is because the dynamics of innovation processes largely determine the efficiency of the oil and gas sector and its useful return to society. All mechanisms of state regulation—licensing, tax, pricing, investment, anti-monopoly, scientific, and technical policy—along with direct state participation in economic activity, affect the dynamics of technological development in the sector. The model of interaction between the state and oil and gas companies is, to some extent, a model for the innovative development of the oil and gas sector. This is especially evident in industrially developed countries like the USA and Norway.

USA The US government's stance on the oil and gas sector is outlined in the 2001 document titled *National Energy Policy*. The document emphasizes energy security, defined as a functioning energy sector that ensures sustainable public welfare growth while preserving the environment. In the US, there is no conflict between high-tech sectors and raw-material-based industries.

Norway In June 2002, the Ministry of Energy presented the White Paper to the Storting (the Norwegian parliament), examining the prospects and challenges of the national oil and gas industry. Two scenarios for the development of oil and gas production on the Norwegian continental shelf were presented: a scenario of declining production and a long-term scenario. The former implies a gradual reduction of the oil and gas industry, while the latter envisions another

100 years of development. The Norwegian government sees the continental shelf as a basis for long-term development and a market for high-tech goods and services related to oil and gas operations.

The interaction of Azerbaijan's oil and gas sector with its economy is extremely close. In Soviet times, extensive development of the oil and gas industry led to declining profitability. This imbalance became critical, prompting a transition to a market economy. During this initial stage, production volumes declined while the influence of the oil and gas sector on the economy and budget revenues sharply increased. For nearly 15 years, Azerbaijan's economy, including its oil and gas sector, has undergone economic transformations marked by uncertainties in scientific and technical priorities.

At the present stage, the role of oil and gas enterprises and the state in ensuring effective functioning and breakthroughs in the gas sector has been re-evaluated. Analysis of the global market reveals that science-intensive products account for \$2.3 trillion, projected to reach \$4 trillion in 15 years. The USA earns \$700 billion annually from high-tech exports, Germany \$530 billion, and Japan \$400 billion.

Azerbaijan's search for effective forms of oil business is driven by the significant role of the oil and gas sector and its competitiveness in the external market. The weakening of favorable internal economic factors such as the inconvertibility of the national currency, cheap labor, and low initial costs necessitates answers to critical questions:

- What is the nature and intensity of specific stimulating factors on innovation in the domestic oil and gas sector?
- What level of competitive advantage should be targeted?
- What are Azerbaijan's opportunities for participating in global oil and gas processes?
- Who are potential partners for strategic relationships in the sector?
- What are the current and future opportunities for implementing technological innovations?

Azerbaijan has accumulated significant experience in field development, but it remains underutilized. Developing oil fields requires complex scientific research, incorporating foreign experience, modern achievements, and economic factors. Aging wells, high formation water cuts, and deteriorating conditions further challenge recoverable reserves. Yet, opportunities exist to increase the raw material base by improving oil recovery onshore and offshore through innovative approaches.

II. Methods

Modernization in Oil Production Three levels of possible modernization can be identified:

- 1.Improvement and optimization of current development system parameters.
- 2.Classification of oil deposits by geological and technical factors to apply modern technologies.
- 3.Organizational and technical changes in production, collection, and preparation structures.

From this point of view, using the accumulated rich scientific and technical experience, Azerbaijan needs to:

1.Develop a mechanism for commercializing technologies suited to its economy:

- Select developments with high commercialization potential.
- Form investment-attractive projects.
- Expand investments for introducing competitive new technologies.
- Reduce investor risks.

1.Establish a constructive system of relationships between government, enterprises, and scientific organizations, ensuring equality and mutual benefit. Strategic goals include improving domestic production efficiency and competitiveness through:

- Property rights protection.
- Improved innovation information support.
- Stable business conditions.
- Tax incentives for innovation.

1.Manage innovations effectively within the oil and gas sector by fostering knowledge management and professional development to compete globally. Key aspects include valuing knowledge, learning continuously, and adopting organizational dynamism.

2.Develop an innovation-oriented approach to subsoil development by creating budgets for exploration, supporting effective technologies, and improving monitoring systems.

III. Results

The global energy mix is expected to undergo a transformative shift by 2050, with renewable energy sources such as wind, solar, and hydropower playing a dominant role. Despite this transition, oil and gas will remain integral to the energy landscape due to their versatility, particularly in industrial applications, aviation, and petrochemicals. Analysts predict that oil and gas will still account for approximately 40-50% of the global energy supply by mid-century, albeit with a reduced share compared to today.

Advances in technology, such as carbon capture, utilization, and storage (CCUS), will enable continued oil and gas production while mitigating environmental impacts. Additionally, the development of hydrogen as a clean energy carrier, often produced from natural gas, will provide new avenues for the oil and gas sector to align with decarbonization goals.

Opportunities for Azerbaijan: Azerbaijan is well-positioned to adapt to these changes and establish itself as a leader in sustainable oil production technologies. Key strategies include:

- Investing in carbon capture and storage (CCS) infrastructure to reduce greenhouse gas emissions from oil and gas operations.
- Promoting the use of digital technologies, such as artificial intelligence and predictive analytics, to optimize resource extraction and reduce waste.
- Diversifying energy exports by developing expertise in hydrogen production and integrating renewable energy sources into the national grid.

- Enhancing collaboration with international energy companies to bring advanced, environmentally friendly technologies to Azerbaijan's oil fields.

- Strengthening educational and research institutions to build a workforce capable of driving innovation in the energy sector.

Through these measures, Azerbaijan can not only maintain its competitiveness in the global energy market but also contribute to the global transition toward a more sustainable energy future.

Conclusion

Taking into account the above, the following main technological and economic principles are highlighted:

- More complete extraction of oil and gas reserves from the subsoil.

- Reduction of investment risks in the development of new oil areas, including deep-seated gas formations.

- Stimulation of the development of small oil fields and deposits that are unprofitable under normal taxation conditions.

- Use of a balanced regime of extraction (equilibrium regime), allowing for the extraction of 10-18% more oil than under "forced" oil extraction.

- Increase in the hydrodynamic continuity of the reservoir through compaction and drilling based on detailed geological modeling of the object and its current oil saturation.

- Effective use of periods of high oil prices by enterprises to fund, at their own expense, capital-intensive work on the construction of new wells.

- Intensive impact on low-productivity, low-water deposits to reduce the heterogeneity (asynchrony) in the rates of reserve development.

- Consideration of the selling price of oil in domestic and foreign markets, as the practice of assessing the effectiveness of technologies and projects based on transfer prices for oil underestimates their economic attractiveness.

- Use of environmentally friendly technologies in the production and transportation of hydrocarbon raw materials.

The main prerequisites for the formation of a scientific approach include diagnostics, interpretation of data from various studies, and decision-making aimed at extending the development periods of fields.

This requires combining the efforts of the oil and gas business and the state to effectively develop hydrocarbon resources for the benefit of society.

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