Environmental Factor as a Threat to the Oil Industry Economic Security

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Abstract

Effective performance of oil industry is a driving factor of the Russian economy growth. Key issues of petroleum industry which to the greatest extent determine its economic security include: high production costs and environmental unfriendliness of oil refining, significant depreciation of fixed assets, low oil refining depth, high consumption of energy and other resources. Being aware of obvious dependence on the largest source of income for the federal budget, on the volume and cost of oil exports, Russian government authorities actively apply the levers of economic and political regulation of the industry in order to stabilize and increase budget revenues. However, the main goal being budget income growth, the government measures often worsen the level of environmental safety for both individual enterprises and the petroleum complex as a whole. In this regard, the environmental factor assessment in terms of t oil industry threat actualizes the issues of careful and responsible long-term environmental trajectory.

Key words: environmental factor, environment, oil industry, responsible investment, ESG, threat countermeasures.

Introduction

Ambiguity inherent in the definition of the term "security" forms the basis of the interpretation of the Energy security concept. The Security – Risk - State Dilemma is typical for most definitions of Russian and international researchers, as well as for rationale contained in official documents [9]. However, due to the fact that the Energy security concept is endowed with more specificity than the notion of "security", researchers put a more specific meaning into it. So, current studies associate energy security not only with resources availability and energy interests' protection, but also with environmental and man-made factors (environmental and anthropogenic safety). The request for minimal harm to the environment, an active scientific and technical process in this area and the use of modern technologies (results of scientific and technical progress) are perceived as integral elements that ensure national energy security.

Materials

The material for the study is the open data of various ratings used assessment and monitoring the environmental factor as a threat to the oil industry management. The authors of the study reviewed and took into account research materials of Russian and

international scientific community who, in their works, had observed the issue of determine concept of the Oil Industry Economic Security. In order to reveal the concept of the economic security of the oil industry to the fullest extent, we list the key tasks for ensuring it:

- ensure stable and sustainable development of the petroleum industry, as well as stable and sustainable development of related sectors of the national economy;
- maintain competitiveness in the struggle for sales and investment markets;
- guarantee a stable positive cash flow and generate sufficient tax and foreign exchange revenues to the federal budget.

When solving the listed tasks, one should not forget about the social, environmental and political contexts within which the listed tasks are to be solved. In recent years, there has been more and more speculations about the high degree of responsibility of enterprises in the extractive sector to society for environmental problems associated with minerals extraction. For example, the environmental disaster that followed Deepwater Horizon oil spill in 2010 polluted a large surface area of the Gulf of Mexico. Scientists

are still debating the long-term consequences that this catastrophe leads to.

Results

In accordance with the present results, extreme negative environmental impact of oil production is one of the most important factors impacting permanently economic security of the oil industry and society in general. This study confirms that environmental pollution factor manifests in the following forms:

1. The extracted resources has signs of increased danger due to their chemical properties (explosion hazard, fire hazard, harmfulness to living organisms and microorganisms);
2. Oil production can cause profound changes in the natural objects of the earth's crust (the depth of changes reaches 10-12 thousand km);
3. Machinery and equipment used for oil production are sources of increased danger;
4. It is necessary for oil production to withdraw from agricultural, forestry and other types of turnover significant land plots. The impact of the oil industry on the environment is global as it affects the airspace, water and land resources.

Overall, environmental hazard can be constant influenced by specific production, and "shock" caused by individual man-made disasters. The latest example of environmental problems caused by mining technology is the development of shale oil fields. As Table 1 shows, oil production through hydraulic fracturing increases greenhouse gas emissions by 70 percent compared to conventional extraction methods. This mining method requires increased volumes of water, produces considerable solid waste and changes the landscapes.

Table 1

Environmental impacts of hydraulic fracturing in the US

Impacts on nature Indicator	Indicator value
Number of wells (since 2005)	82000
Toxic water discharges (2012), million cubic meters m	1064
Used water (since 2005), million cubic meters m	950
Used chemicals (since 2005), million cubic meters m	7,6
Greenhouse emissions (since 2005), million tons of CO2-eq.	100
Land disturbance, (since 2005), sq. km	1465

Source: compiled by author according to [2]. [2].

This also accords with our earlier observations, which showed that anthropogenic impact is more even dangerous as it is more localized and targeted; for instance, the largest marine oil spill in history is an unprecedented disaster which irretrievably impacted ecosystems. For 89 days, from 6 to 9 million barrels spilled into the waters of the bay; the surface of the golf that was contaminated ranged from 8000 to 24000 km2, the mouth of the Mississippi and 1200 km of the coast were contaminated as wee, 300 species of birds, 1200 species of fish, 1500 species of crustaceans and mollusks, 4 species of sea turtles and 29 species of mammals were brought to the brink of extinction. For BP, the catastrophe cost $3.5 billion to clean up the leak and $20 billion for the formation of the Spill Elimination Fund.

The general consequence of the negative impact on the environment, as a rule, is the increasing costs of eliminating the negative impact, the negative image of the oil industry in the eyes of the population. The criteria for assessing the level of impact of the environmental factor is the amount of costs to eliminate the negative impact on the environment, as well as the amount of costs to prevent such an impact, including through innovative solutions.

However, the environmental agenda is not the main driver of innovation in the oil industry. As a rule, the following reasons are distinguished: increasing the efficiency of oil production by creating new methods of influencing reservoirs and increasing the

oil recovery factor; increasing the efficiency of exploration work through the development of advanced geophysical and geochemical methods for studying rocks, improving methods for assessing initial and residual hydrocarbon reserves; development and development of technical solutions for the exploration and development of deposits of the Arctic shelf; development of technical means for the development of hard-to-recover and unconventional oil and gas resources (tar sands, oil shale, gas hydrates); development of efficient energy and resource-saving technologies aimed at the rational use of limited raw materials and reduction of hydrocarbon losses throughout the entire technological production chain; development and implementation of environmentally friendly methods and technologies for the exploration and production of hydrocarbons, which is especially important in connection with the increasing environmental requirements [5]; growing depth of oil refining; production of petroleum products that meet modern technical and environmental requirements [4].

Among the leading countries in innovation in the oil industry, the United States should be noted, which, using scientific and technical factors, was able to strengthen its geopolitical position, strengthening the economic security of the oil industry in their country and shaking it in others. American oil producers have been able to apply the following innovative oil production technologies that were previously considered impossible: horizontal drilling,

which provides deep underground penetration into shale layers; hydraulic fracturing is a technology used to extract oil and gas from rocks [4].

As a result of the use of these innovative technologies, the US managed to significantly increase energy production, improve the efficiency and economic security of the oil industry as a whole and become the leader with a record volume of production, surpassing Saudi Arabia and the Russian Federation. In 2022, the US produced about 11.8 million barrels per day per day, which is 16% more than in the previous period, while these figures for Saudi Arabia amounted to 10.02 million barrels per day, and Russia has 10.8 million barrels per day [8].

In accordance with the present results, the introduction of innovations is a capital-intensive process. Most Russian and global companies make significant investments in environmental protection being based on several tasks at once including:

1. to prevent negative impacts on the environment due to anthropogenic disasters, as well as resulting from production processes and the reduction, result of such activities of current and future mandatory payments in favor of the state and victims;
2. to improve the company's image.

Due to the lack of comprehensive statistics on investments in environmental protection by oil companies at the global level, we will consider this indicator based on Russian statistics (see Table 2).

Table 2

Investments in fixed capital aimed at protecting the environment and rational use of natural resources in the Russian Federation in 2018-2021

Indicator	**2018**	**2019**	**2020**	**2021**
Investments, million rubles	861201,2	705938,9	976364,6	1296146,2
Russia Ruble Average annual Exchange rate against USD	62,5416	64,7276	71,9422	73,6457
Investments, million USD	13770,05	10906,30	13571,51	17599,75
Oil production Volumes by Russian companies, thousand barrels per day	11600	11490	10111	10460
Volume of oil production (thousand barrels per day) per $1 million investment in the industry	0,84	1,05	0,75	0,59

Source: compiled by authors.

As we can observe from Table 2, on average in Russia, 0.8 thousand barrels of oil are produced per 1 million dollars of environmental investments. However, between 2007 and 2013 this ratio fluctuated in the range from 16.33 thousand barrels per day per 1 million dollars of investment to 20.81 thousand barrels per day for 1 million dollars of investment. Production volumes per investment have been declining significantly over the years due to increased investment, which is a positive trend. This raises the question of how these funds will be spent.

Paradoxically, the decrease in investment activity in the oil industry on the international raw materials market is considered by some analysts as a factor contributing to the elimination of the crisis situation, which, however, is true only in the short term, since a long-term decline in investment can lead to deficit formation.

In this study, we have conducted a correlation analysis of the impact of institutional, technological innovation, economic investments, fiscal regulatory instruments on the level of counteracting environmental risks From the standpoint of minimizing environmental risks of the economic security of the petroleum industry.

Table 3

Ratio of tools to counter economic security threats of oil industry and the environmental factor impact

Factor / Tool	I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	I_{10}
Environmental factor		+	+		+	+		+	+	+

Source: compiled by the authors.

In table 3, the following designations are accepted: I1 is referred to as documented agreements of international and regional organizations; I2 is a mechanism for stimulating private venture capital investment; I3 is technology transfer application; I4 is the financial market administrative regulation; I5 refers to as concessional agreements conclusion; I6 is conclusion of production sharing agreements ; I7 is industrial clusters formation; I8 applies to financing of promising projects from state investment funds; I9 relates to industrial assets exchange in the energy sector; I10 is oil industry tax regulation.

As can be observed from Table 2, the following institutional instruments have the greatest environmental factor impact: stimulating venture capital investment in the private sector; technological innovations as the use of technology transfer;

investment and economic nature as the conclusion of concession and production sharing agreements, financing of promising projects from state investment funds and the exchange of industrial assets in the energy sector; as well as fiscal and regulatory nature as tax regulation of oil industry.

Discussion

This result may be explained by the fact that priority attention should be given to such an instrument as a mechanism for stimulating venture capital investment in the private sector.

This tool can be actively used both within individual oil companies in relation to internal projects, and in relation to external promising projects. Venture financing typically affects the following main areas of an oil company performance as: geological exploration, environmental and technical safety, innovative methods of oil production and refining. Additional advantages of venture financing for small start-ups in the oil sector is access to innovative technologies without attracting significant financial resources, ability to hedge their own risks, and achieving a balanced innovation portfolio.

Since reaching a peak, a large-scale practice of venture financing of pin oil industry projects appeared in the mid-2000s

aimed at joint venture funds for financing the development of shale oil fields [7]. The venture investors target segment include small high-tech companies. At the same time, the United States and, with a slight lag Western Europe became the leaders in the implementation of venture capital investments.

Currently, venture capital is attracted to the oil industry in two main areas [4]:

- attracting external financing from a venture fund, which due to its specifics is focused on the development and maintenance of technologies in the field of oil exploration, production and refining ;
- external and internal financing attraction from venture funds created by individual corporations (Saudi Aramco, Eni S.p.A. and Statoil), as well as internal divisions of corporations (BP, Chevron, ConocoPhillips and Shell).

One example of intra-corporate venture investments by oil companies is the Game-changer.vc fund [6] supported by Shell in order to identify and implement innovative ideas in the production process in tech founders building software or other technological solutions. This program is aimed at finding ideas for innovative projects based on cooperation with universities in the USA and

Western Europe, venture capital firms, and the firm's staff. The company launched the program in 1996 and up to date about 300 ideas have been brought to the stage of commercial implementation.

It should be noted that this instrument, due to its narrowly localized impact, does not have any noticeable impact on the industry in the short term, however, in the medium and long term, the consequences of using this instrument may be significant. An example is venture investments in shale deposits which subsequently significantly changed the structure of the entire oil market. In this respect, therefore, it seems that the time lag of using this tool is greatly extended in time. The development conditions for venture financing of projects in the industry are a favorable economic situation in the country and the industry, as well as a stable regulatory framework that is favorable for investment in general.

Conclusion

Summing up, it should be noted that on the basis of the analysis carried out, these findings raise questions regarding the nature and extent of forming cluster of tools that affect the environmental factor. This allows planning and developing

comprehensive measures to minimize the negative impact on the environment at the national and international levels, while maintaining economic growth rates, which is especially important in a highly volatile environment.

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