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PROSPECTS OF OIL PRODUCTION IN THE RUSSIAN ARCTIC: TECHNOLOGICAL ASPECT

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Purpose: The purpose of the article is determining the prospects of oil production in the Arctic from technological point of view.
Design/methodology/approach: The study uses qualitative analysis in order to gain insights into the realistic prospects and the key aspects of the development of the Arctic shelf. The methods of strategic analysis were adopted to determine the main strategic directions of technological development of offshore projects. Reliability and validity of the obtained results are established due to the usage of modern legal and regulatory framework and data of the "Gazprom" and "RosNeft" oil companies.
Findings: The study offers an approach to investigation of problem of Arctic oil and gas projects' technological support. This paper provides the strategies of technological aspect's future development and analyses opportunities of their implementation in current circumstances.
Research limitations/implications: The relevance of this research is connected with increasing interest in the extraction of mineral resources in Russian Arctic.
Practical implications: The findings of this study have a number of important implications for future practice within determination of the realistic prospects for development of Russian Arctic shelf.
Originality/value: The problem of the development of offshore oil and gas Arctic projects has risen recently on a world scale due to the depletion of traditional overland oil and gas fields. This study has provided a deeper insight into strategic directions of providing the Russian offshore projects with required technologies. The possible ways were divided into three strategies: import-oriented strategy, cooperation strategy and intra-oriented substitution strategy.

Keywords: Arctic shelf, technologies, oil and gas projects, strategies, prospects.

Category of the paper: General review.

1. Introduction

The problem of the development of offshore oil and gas Arctic projects has risen recently on a world scale due to the depletion of traditional overland oil and gas fields, as well as the discovery of hydrocarbon reserves in the Arctic seas (Emmerson, 2012; Conley, 2013; Hansen, 2016).

Effective development of Russian Arctic oil and gas resources has strategic importance. However, it is the most complicated direction of national oil and gas industry development (Kozmenko et al., 2019; Opportunities and challenges for Arctic oil and gas development). In terms of technologies, implementation of offshore oil and gas projects is a knowledge- and capital-intensive process (Ilinova, and Solovyova, 2018). Extreme climate conditions (permafrost, low temperatures, strong underwater currents), complicated geological features of deposits, heightened risks of ecological damage and lack of infrastructure require development and introduction of unique technological solutions (Istiomin et al., 2007; Malashenkov, and Akchurin, 2015).

There is no consensus on how to ensure the development of Arctic oil and gas resources and required technologies and equipment. The situation is compounded by impact of sanctions imposed by the U.S. and Europe regarding Russian oil and gas industry. There is no significant experience in Russia in implementation of offshore projects. Moreover, Russian oil and gas industry uses a large number of foreign technologies. These factors do not allow realizing the import substitution policy in the short-term period (Prospects for Russian oil production: life under sanction, 2018).

In the current circumstances, it is important to formalize the possible ways of technological support of Arctic projects. The investigation and forecasting of technological aspect could be a basis for determination of reliable prospects of Arctic resources development in the medium- and long-terms.

2. Literature review

The problems and prospects of Arctic zone development, as well as development of oil and gas offshore projects are under discussion among Russian and foreign scientists (Emmerson, 2012; Conley, 2013; Hansen, 2016).

There is a large number of published studies describing the role and strategic importance of the Russian Arctic hydrocarbon resources development (Istomin et al., 2007; Cherepovitsyn et al., 2017; Kozmenko et al., 2019 among many others). However, the reliable prospects of national offshore projects implementation remain uncertain (Ilinova et al., 2018).

Numerous studies have attempted to form long-term forecasts of the development of Arctic shelf. Nevertheless, forecasts offered are mainly theoretical (Malashenkov, and Akchurin, 2015; Morgunova, 2017; Savinov, and Ganzhinova, 2017). Several studies have begun to examine the technological aspects of the Arctic shelf development (Faltsman, 2015). However, such studies remain narrow in focus, dealing only with general direction of import substitution in oil industry.

The study deals with the investigation of technological opportunities in case of Russian Arctic projects implementation. That is why it is based on national reports, papers and scientific articles. In foreign literature there are no studies connected with Russian import substitution policy within national engineering and assessment of national technological strategies.

Thus, the issue of the ensuring technological possibility of Russian offshore projects remains open. This leads to relevance of the research.

3. Methods

The study uses qualitative analysis in order to gain insights into the realistic prospects and the key aspects of the development of the Arctic shelf. The paper uses the results achieved by the authors of the paper in the field of forecasting of Arctic oil and gas projects' development (Ilinova, and Solovyova, 2017; Ilinova et al., 2018).

The methods of strategic analysis were adopted to determine the main strategic directions of technological development of offshore projects. Reliability and validity of the obtained results are established due to the usage of modern legal and regulatory framework and data of the “Gazprom” and “RosNeft” oil companies.

4. Results

In the future, the Arctic shelf may become the main source of hydrocarbons. According to preliminary estimates by experts, it accounts for about 70% of oil and up to 90% of gas of all Russian offshore resources. Recoverable oil reserves are estimated at 400 million tons (Fadeev, 2012; Ilinova et al., 2018; Cherepovitsyn et al., 2017).

In recent years, Russia has strengthened its efforts aimed at development of the Arctic shelf. Number of the State initiatives in stimulating of offshore oil production have been accepted. However, the only implemented project remains the “Prirazlomnoe” platform, operated by “Gazprom neft shelf” company. In the next 5-7 years it is possible to begin the implementation of the offshore oil field “Dolginskoe” project. Prospects for development of the remaining

offshore projects stay indeterminate. It is connected with a lot of factors, including uncertainty in technological availability for future projects (Kozmenko et al., 2019; Ilinova, and Solovyova, 2018).

Currently about ten countries operate on the Arctic shelf. Most of them own technologies for development of offshore reserves that are very complex. For this reason, the availability of technologies and equipment is recognized as a key factor that may determine the prospects of Arctic shelf development (Fadeev, 2012).

It is important to note that Russia does not have extensive experience in development of Arctic shelf (Fadeev, 2012). As a result, the import of technologies is the most probable way. This solution does not require significant investments in research and development (R&D) and commercialization (Morgunova, 2017; Savinov, and Ganzhinova, 2017). To date, the import dependence in such technologies as deep-sea mining systems, wellhead assembly, technological equipment for ships reaches an estimated 80-90%. At the same time, following the import-oriented strategy is restricted now. This is due to the sanctions imposed by the U.S. and Europe that affect Russian oil and gas sector. Limitations are connected with import of certain types of crucial technologies, including equipment for Arctic oil and gas production. To date, the list of technologies prohibited to import includes such positions as drilling installations, completion equipment, drill-pipes, well casings, high-pressure pumps, remotely operated special equipment, valves, etc. (Ilinova, and Solovyova, 2018).

The sanctions imposed had a significant impact on prospects for implementation of further offshore projects. The collaborative project between Exxon Mobil Corporation and “RosNeft” company was suspended and is not supported now (“Universitetskaya-1” wellsite and “Tuapsinskoe” field). Also in view of the sanctions, Exxon Mobil Corporation removed from a list projects including “Yuzhno-Chukotskiy”, “Severo-Karskiy”, “Ust-Lensky”. This restricted to a significant degree the access to technologies for “RosNeft” company (Prospects for Russian oil production: life under sanction, 2018).

However, sanctions, despite the obvious negative effects, represented an incentive to determination of priorities in the import substitution direction in Russia. In recent years there were developed and adopted plans for development in oil-and-gas machine building and related industries (Kozmenko et al., 2019).

It is obvious that the direction of reduction of foreign import and the development of national technologies is one of the most favourable ways for Russia in current circumstances. In this vein, it is possible to discuss two main directions. The first one is related to cooperation with foreign counterparts through the creation of joint ventures (alliances). The second one is to develop the national industry by using own resources (Prospects for Russian oil production: life under sanction, 2018).

The establishment of joint ventures with external partners is based on the possibility for Russian companies to collaborate with Asia-Pacific partners that are one of the world leaders in engineering and building of offshore platforms. The formation of alliances might be

an “interim step” between current situation and targets within import substitution (Prospects for Russian oil production: life under sanction, 2018).

In general, the ways for achieving the technological availability for Russian offshore projects can be divided into three main strategies: import-oriented strategy (focus on purchase of complete technological solutions), cooperation strategy (relate to formation of joint ventures with foreign partners) and intra-oriented substitution strategy (creation of own production companies). Each of the strategies mentioned offers different ways of achieving the technological availability and has specific advantages and disadvantages. Table 1 presents an overview of the strategies formed.

Table 1.
Strategies for technological availability for the Arctic shelf projects

Indicators	**Strategies**		
	Import-oriented strategy	**Cooperation strategy**	**Intra-oriented substitution strategy**
Model	based on the import of foreign technologies	based on the creation of joint ventures	based on the development of domestic technologies
Targets	purchase of ready technologies and equipment, as well as service support	development of technological base through interaction between Russian and foreign partners (alliances)	substitution of imported technological solutions with domestic technologies and equipment, as well as service support
Limitations	extension of the existing sanctions and expansion of the list of sectoral and project sanctions imposed, limiting the import of specialized deep-water equipment and technologies for the development of offshore fields	multidirectional interests of attracted foreign partners; uncertainty in establishing the forms and conditions of interaction (an inadequacy of the Russian legal and regulatory system in the field of the continental shelf development)	lack of the necessary base for accelerated development of the national oil and gas engineering industry; the fragmented policy of import substitution
Potential advantages	relatively low financial costs (no need to invest in R&D and commercialization); the ability to adapt and use the innovative technological solutions in the national industry	involvement of new strategic partners to funding offshore projects on the basis of long-term cooperation; the development of innovative technologies using the experience of foreign countries; the formation of new competencies based on foreign experience	accumulation of own resources; increasing the sustainability of Russian offshore projects; development of the national machine-building complex; unidirectional goals and objectives of the State and national oil and gas companies
Potential disadvantages	increased degree of dependence on geopolitical factors, high probability of contracts suspension with a number of foreign partners in joint projects (as is the case with the project for the “Universitetskaya-1” wellsite and “Tuapsinskoe” field)	open policy regarding the implementation of Russian shelf projects, loss of sovereignty in the framework of strategic decision-making; dependence of the shelf development prospects on foreign partners	high costs for the development of science and technology base through the use of its own resources; long term development of new industries; risks of non-compliance of the developed technologies with the declared goals; complexity in building integrated complexes

Cont. table 1.

Prerequisites for implementation	1. The maintenance of existing long-term contracts with foreign suppliers of technologies and equipment from Schlumberger, Western Geco Halliburton, Baker Hughes, GS, Sea Bird Exploration, etc. under the approved conditions; 2. The ability to maintain the current level of imports of technologies and equipment for individual items not included in the sanction list; 3. The continuing possibility of service maintenance of equipment acquired earlier; 4. The possibility of search for new suppliers.	1. The experience in the implementation of joint projects with foreign partners in certain technological areas (for example, the project being implemented by the shipbuilding complex Zvezda together with the Dutch company Damen and the Singaporean company Keppel); 2. The experience of Russian oil and gas companies within the framework of joint projects with foreign companies (Shtokman Development AG; the cooperation of RosNeft company with an Italian company Eni and others.); 3. Expanded interaction with Asian partners on offshore resources development - Keppel (Singapore), COSMO Shipyard (China), Shanghai Waigaoqiao Ship-building Ltd (China), Samsung (Korea), SHI (Korea).	1. Implementation of import substitution policy in the Russian fuel and energy complex, the establishment of key indicators of reducing import dependence for each of the technological areas ("Action plan for import substitution in the industry of oil and gas engineering of the Russian Federation"); 2. Establishment of the Competence Centre for Import Substitution in the Fuel and Energy Complex; 3. The implementation by the Ministry of Industry and Trade of programs for subsidizing the costs of research and development, for compensating interest rates on loans; 5. Development of the Special investment contract (SPIC) mechanism with respect to offshore projects.

Note. Created by the authors with use of the following sources: "Improvement of economic approaches to the management of Arctic marine hydrocarbon fields development" by A. Fadeev. 2012; "Technological aspects of development of Russian Arctic shelf resources" by A. Ilinova and V. Solovyova. 2018; Prospects for Russian oil production: life under sanction, 2018.

Ultimately, the technological aspect is determinative from a perspective of establishing reliable prospects of Russian Arctic shelf future development. The choice of a particular strategy must be done through comparison of possible advantages and disadvantages of each solution. It is also important to assess the regulatory impact of the strategies on different types of stakeholders: the State, Russian oil and gas companies, the machine-building complex etc. The indicators of cost management, quality management and results management might realize the quantitative evaluation of strategies offered.

5. Discussion

The present study was designed to determine the prospects of oil production on Russian Arctic shelf in the context of technological support. The results indicate that there is high level of uncertainty in this area. The sanctions imposed, the lack of Russian technologies,

the suspension of a number of offshore projects show the relevance of search for ways of solving the technological problems.

The strategies offered allow formalizing the list of strategic alternatives regarding technological development. The study shows the qualitative analysis of these alternatives. The authors discuss possible advantages and disadvantages, targets, limitations and prerequisites for implementation of the formed strategies. To identify the main trends of the development of the Arctic shelf, the authors developed and launched a special questionnaire. It includes also a section with questions about technological problems of offshore projects. Therefore, the findings obtained in the present research have important implications for the authors' research investigating the prospects of the development of the Arctic shelf.

6. Conclusion

To sum up, the technological availability is one of the main challenges the State and Russian oil and gas industry is facing. This factor is crucial to ensure prospects and to keep sustainability within development of resources of Russian Arctic shelf. The Arctic Zone's conditions connected with extreme climate conditions, difficult geologic structure etc. require application of special innovative technologies and equipment. At the same time there are different ways to provide Russian oil and gas industry with necessary technological solutions.

This study has provided a deeper insight into strategic directions of providing the Russian offshore projects with required technologies. The possible ways were divided into three strategies: import-oriented strategy, cooperation strategy and intra-oriented substitution strategy. The choice of the most appropriate strategy is an important step in the existing circumstances of uncertainty. Each of the strategies offered has special advantages and disadvantages that were discussed in this research.

The findings of this study have a number of important implications for future practice within determination of the realistic prospects for development of Russian Arctic shelf.

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References

1. Cherepovitsyn, A., Fadeev, A., Larichkin, F., Agarkov, S. (2017). The features of oil & gas complex's strategic management and hydrocarbon products transportation at developing marine oil & gas fields in Arctic. *Bulletin of Murmansk state technical University, 4(20)*, 742-754. doi: 10.21443/1560-9278-2017-20-4-742-754.
2. Conley, H.A. (2013). Arctic Economics in the 21st Century. The Benefits and Costs of Cold. *Center for Strategic & International Studies, 74*.
3. Emmerson, C. (2012). *Arctic Opening: Opportunity and Risk in the High North*. Lloyd's and Chatham House. Retrieved from http://www.lloyds.com/~/media/Files/News%20and%20Insight/360%20Risk%20Insight/Arctic_Risk_Report_20120412, 05.07.2019.
4. Fadeev, A. (2012). Improvement of economic approaches to the management of Arctic marine hydrocarbon fields development. *Apatity*, KSC RAS.
5. Faltsman, V. (2015). Forcing import substitutions in a new geopolitical situation. *Studies on Russian Economic Development, 1(26)*, 22-32. Retrieved from https://elibrary.ru/item.asp?id=23803901, 05.07.2019.
6. Hansen, B.L. (2016) Arctic oil & gas – Challenges and opportunities. UNIS, Longyearbyen. Retrieved from https://www.unis.no/wp-content/uploads/2016/04/Bengt-Lie-Hansen-Oil-and-gas-in-Arctic-April-12-2016.pdf, 18.07.2019.
7. Ilinova, A., Chanysheva, A., Kourentzes N., Svetunkov, I. (2018). *Producing long-term forecasts of the development of Arctic shelf. Innovation-Based Development of the Mineral Resources Sector: Challenges and Prospects*. XI Russian-German Raw Materials Conference Committee, 1, 539-553.
8. Ilinova, A., Solovyova, V. (2017). Technological problems of the development of hydrocarbon shelf resources of the Russian Arctic. *Oil and gas of Western Siberia: materials of the International scientific and technical conference, 3*, 104-106. Retrieved from https://www.tyuiu.ru/wp-content/uploads/2015/02/Neft-i-gaz-Za-padnoj-Sibiri-Tom-3.pdf, 04.07.2019.
9. Ilinova, A., Solovyova, V. (2018). Technological aspects of development of Russian Arctic shelf resources. *The North and the Market: Forming the Economic Order, 4(60)*, 32-42. doi: 10.25702/KSC.2220-802X.4.2018.60.32-42.
10. Istomin, A., Pavlov, K., Selin, V. (2007). Hydrocarbon resources of the western Arctic shelf of Russia: problems, development prospects. *Digest Finance, 3(147)*, 2-7. Retrieved from https://elibrary.ru/item.asp?id=9441803, 08.07.2019.
11. Kozmenko, S., Saveliev, A., Teslya, A. (2019). Global and regional factors of industrial development of the hydrocarbons of the continental shelf of the Arctic. *News of St. Petersburg state economic University, 3(117)*, 65-73. Retrieved from

https://cyberleninka.ru/article/n/globalnye-i-regionalnye-faktory-promyshlennogo-osvoeniya-uglevodorodov-kontinentalnogo-shelfa-arktiki, 14.07.2019.

12. Malashenkov, B., Akchurin, L. (2015). Problems and prospects for the development of oil and gas fields on the Arctic shelf of the Russian Federation. *Moscow University Bulletin. Management (state and society), 2(21)*, 49-64. Retrieved from http://www.spa.msu.ru/uploads/files/stati/malashenkov_akshurin.pdf, 11.07.2019.
13. Morgunova, M. (2017). *Prospects for the development of hydrocarbon resources of the Russian Arctic shelf in the context of the transformation of world energy* (The thesis for the degree of candidate of economic sciences). Moscow: National University of Oil and Gas "Gubkin University".
14. Opportunities and challenges for Arctic oil and gas development. Eurasia Group report for The Wilson Center, Washington, D.C. Retrieved from https://www.wilsoncenter.org/sites/default/files/Artic%20Report_F2.pdf, 11.07.2019.
15. Prospects for Russian oil production: life under sanction. Available online https://energy.skolkovo.ru/downloads/documents/SEneC/research04-ru.pdf, 01.07.2019.
16. Savinov, Y., Ganjinova, S. (2017). Prospects of Russia's shelf projects in the Arctic Region. *Russian foreign economic bulletin, 4*, 25-32. Retrieved from https://cyberleninka.ru/article/n/perspektivy-rossiyskih-shelfovyh-proektov-v-arktike, 14.07.2019.