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Algorithm for assessing the prospects of offshore oil and gas projects in the Arctic

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Abstract

Russia is one of the key players in the Arctic with ambitions to continue development its Arctic oil resources. Nowadays the only fully launched oil and gas offshore project in Russia is the platform Prirazlomnaya, a number of other projects are at the various stages of realization and their prospects remain unclear today. There are a number of factors that are preventing Russia from fully developing its offshore Arctic oil potential. The aim of this paper is to create a methodological base for assessment of prospects of Arctic offshore projects. We develop an algorithm for such assessment, which consists of three stages: (i) general expert survey; (ii) informational basis development; (iii) specific expert survey. We are focusing on the specific features of the Arctic oil and gas projects, possibilities of using existing forecasting methods, as well as on the complex approach to our research.

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1. Introduction

Development of the Arctic shelf is of great interest both in business and science around the world. The most attractive for exploration and production energy resources in the Arctic zone are oil and gas. It is difficult to estimate the amount of hydrocarbons in the Arctic, because the level of geological exploration is very low. Current estimates of oil and gas resources in the Arctic vary between 3% and 25% of the world total, mostly on the Russian territory [1], but the viability of their extraction depends on a shifting economic, political, market and technological factors. These facts draw attention to the implementation of offshore oil and gas projects today and in the future. A number of factors create considerable degree of uncertainty in the development of Arctic shelf that confirms the relevance of the study of prospect of oil and gas offshore projects. Taking into account the research background, we can conclude that the complex approach for assessment the prospects of such projects is needed. In the light of earlier conducted researches [2–4], in this paper we suggest the methodological integrated approach to forecast the future and prospects of oil and gas offshore projects.

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2. Methodology

2.1. Literature review

It is well-known that the Arctic is an issue of global concern recently, in particular because of significant hydrocarbon resources on these territories. The majority of the papers, devoted to the Arctic, are written in the publicist genre and present analytical investigations. As for the academic debates, different authors discuss geopolitical, economic, political situation, related to the Arctic. There are a number of Russian scientists which pay attention to the investigation of prospects of the hydrocarbons production in the Arctic (Amiragyan [5], Mitrova et al. [6], Nikitin and Dzublo [7], Nikolaeva [8], among many others). As for assessing prospects of the Arctic oil and gas projects in general, some scientists predict bright future for offshore projects [9], while others are not so optimistic [10]. But all the experts recognize strategic importance of offshore oil and gas production for the national economy in the long-term period. From our previous studies we can conclude that this area is poorly studied. We suppose that integrated approach is needed.

2.2. Research background and design of the study

The previous study was devoted to the development of so-called TESCIMP-methodology — a tool that provides an integrated approach to the analysis of the prospects of oil and gas Arctic projects. It considers the specifics of hydrocarbon production in the Arctic from offshore fields. Thus, we assigned six key factors affecting the implementation of projects: (i) Political factors (P); (ii) Macroeconomic factors (M); (iii) Climatic and geological factors (C); (iv) Technologies (T); (v) Infrastructure (I); (vi) Environmental Safety (ES) [2]. Each factor lists a number of indicators different in nature and grade of influence that contribute to the evaluation of the prospects of the Arctic oil and gas offshore project. They were divided into two groups — essential and stimulating indicators which are qualitative and quantitative respectively.

Assessing the prospects of the Arctic oil and gas offshore project is a problem which can hardly be formalized. This is due to the complexity of the socio-economic system considered which comes out of multiple interrelationships between its elements. Each Arctic offshore project is unique, so the decision-making process is conducted in the high level of uncertainty. Regarding this, we performed an analysis of forecasting methods that could be used for assessing the prospects of such projects. We based it on the availability and nature of information on TESCIMP-indicators that can be used in the formation of such forecasts. We argue that expert forecasting methods are inevitable in this subject area partly due to the lack of background data for most of TESCIMP-indicators used to assess project prospects. Moreover, project's prospects are estimated for the long term. For that reason statistical methods could not be used for solving this general task, but can provide quantitative informational basis to help get reliable forecasts on particular indicators [4].

So, long term forecasting methods should necessarily be involved regarding the specifics of the research. In particular, expert methods seem to fit best to solving such a complex problem. The accuracy of the assessment in this case is achieved by attraction a number of specialists of different profile and stepwise adjustment of the forecasts received by different experts as well as their consistent interconnection. The methodology described could be easily implemented both by managers of the oil and gas companies and independent research groups. This is due to concrete algorithm and practical tools developed within the research. It also seems to be universal in nature as it bases on indicators inherent all arctic offshore projects.

During this study we focus on a general mechanism for assessing any Arctic offshore oil and gas project that could be universal and objective. For that reason we do not drop to investigation of individual project characteristics but dwell on general factors and key ideas that should be kept in mind and taken into account in the decision-making process. As a result, we expect to receive forecasts of prospects for the implementation of an Arctic offshore project. So, we develop an algorithm for assessing its prospects which consists of three main steps (Fig. 1). The algorithm involves a complex approach to forecasting the project's prospects. It means the forecaster uses both statistical and expert forecasting methods in solving the abovementioned problem.

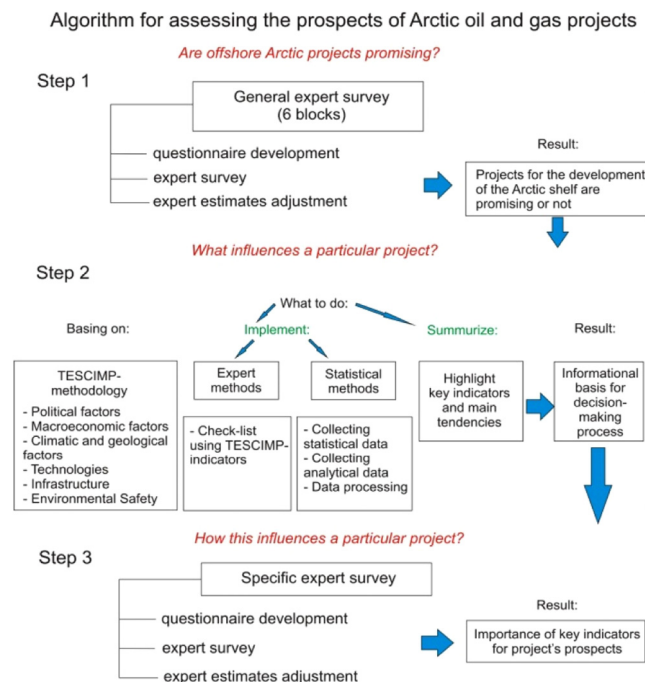


Fig. 1. Algorithm for assessing the prospects of Arctic oil and gas projects.

3. Results

3.1. General expert survey

The first step of our research, according to the abovementioned suggested approach, is devoted to the general expert survey. We assume that this survey will give us comprehensive experts' opinion about prospects of Arctic oil and gas shelf development. The results of this survey will be used within the Step 2 of our research as the part of informational basis for experts, as well as for preparing the specific survey (Step 3). We consider this step as a chance to collect a lot of information from the Russian experts in different fields to provide more reliable basis for the further research. We developed the questionnaire which consists of six parts: (i) general issues of oil and gas industry development; (ii) prospects of development of offshore oil and gas projects in the Arctic; (iii) international cooperation; (iv) key tasks of government and business; (v) financing and investment prospects of offshore projects; (vi) technologies. As an example, we present the Part 2 of the questionnaire (Fig. 2). The research work associated with general survey implementation and data processing is being done at present, the results will be demonstrated in the subsequent publications.

3.2. Informational basis for experts

Step 2 bases on TESCIMP-methodology and consists of collecting statistical and analytical data on particular TESCIMP-indicators and implementing both statistical and expert forecasting methods. Statistical methods serve mainly to produce individual forecasts on key quantitative indicators for the short-term. Within our research we assume that one of the main quantitative indicators significantly affecting the prospects of oil and gas offshore projects is the price of crude oil. Increase in oil prices could positively affect the economic efficiency of such projects, influence the cash flow and improve such indicators as NPV, PI, IRR and DPBP. The oil prices have the paramount importance for offshore projects as the cost of oil production on the shelf is much higher than onshore, and the projects are capital intensive. According to Russian experts, the oil price is supposed to be around 75–100 U.S. dollars per barrel for successful implementation of offshore oil and gas projects. The research conducted

2.1. Is development of offshore oil and gas projects in the Arctic strategically significant priority for Russia?	a) Yes	
	b) No	
	c) Don't know / No answer	
2.2. What regions of the shelf can be considered as the most perspective for oil and gas extraction in the medium-term period?	a) Caspian region	
	b) Sakhalin	
	c) Arctic	
	d) Black sea	
2.3. Estimate the level of impact of the factors on development of offshore oil and gas projects in the Arctic (on 5-grades scale: 1 – no impact; 2 – insignificant impact; 3 – average impact; 4 – higher than an average impact; 5 – huge impact)	Factors	
	Harsh weather and environmental conditions	
	Complex geological factors	
	Low level of geological exploration	
	Lack of infrastructure	
	Low level of social and economic development of the Arctic region	
	Lack of highly-qualified personnel	
	Remoteness from the large industrial centers	
	Low level of stability of the Arctic ecosystems	
	Others:	
2.4. What, in your opinion, is (are) the key problem (problems) interfering implementation of offshore oil and gas projects?	Low economic efficiency of the projects	
	Lack of experience	
	Lack of money	
	Lack of highly-qualified personnel	
	Lack of domestic equipment and technologies	
	Political sanctions	
	Tightening of environmental international standards	
	Others:	
	2.5. What can become the driver for development of Russian offshore oil and gas projects?	Increase in oil prices
		Government support (tax preferences, Public Private Partnership)
International cooperation with Asian partners		
Active policy of import substitution of equipment and technologies		
Weakening of sanctions from the U.S. and the EU		
Considerable decrease in oil production from onshore fields in Russia		
Others:		
2.6. What, in your opinion, is an extent of impact of the sanctions from the U.S. and the EU on implementation (or plans) of Russian oil and gas offshore projects?	Significant negative impact, especially on the financial and technological spheres	
	Significant negative impact, especially on the financial sphere	
	Significant negative impact, especially on the technological sphere	
	No significant impact on the implementation of the existing and planned projects	
	Sanctions are the incentives for the strengthening of the import substitution policy (positive impact)	
	Others:	
2.7 Do you consider development of offshore oil and gas projects in the Arctic as reasonable in current conditions?	a) Yes	
	b) No	
	c) Don't know / No answer	

Fig. 2. Questionnaire form, part 2 — Prospects of development of offshore oil and gas projects in the Arctic.

allowed the authors to highlight those TESCIMP-indicators that can form statistical and analytical background for the experts and support decision-making process. As a result of the research work we summarize all the key information that might help experts during subsequent specific survey in the form of the pivot table (Table 1).

The table includes a list of TESCIMP-indicators that we assume as the most important ones when talking about the prospects of the project implementation as well as the key information on its current tendencies and possible impact.

3.3. Specific expert survey

We assume that Step 3 of our research will be devoted to the specific expert survey. Steps 1 and 2 are supposed to create the basis for Step 3, whereas at this stage we are going to develop a short list of the key indicators which affect the prospects of implementation of offshore oil and gas projects. The key role of the expert will consist in an assessment of the importance of each indicator in the whole estimate. We suppose that experts will use the coefficients as the parameters which reflect the importance (or “weight”) of each factor or indicator in comparison with the others. Finally, it will allow assessing the impact of the factor or indicator on the prospect of the offshore project. The reliability of the planned results can be supported by obtaining expert opinions at Step 1, creating an informational basis for the decision making process during Step 2, and possibility of updating the list of indicators

Table 1. Informational basis for specific survey.

TESCIMP-factors	Key TESCIMP-indicator	Key information for experts
Political	Availability of foreign capital, technologies, machinery and oilfield services necessary to develop the field	Implementation of sanctions restrictions for using foreign technologies and capital still play the determining role in assessing the prospects of a particular Arctic offshore project. According to experts, the replacement of a number of equipment and systems of Arctic execution with domestic counterparts is not possible before 2020–2025. State support of Arctic projects within the import substitution policy can increase significantly the prospects of a particular project.
Macro-economic	World prices for oil and gas	The indicator has rich statistical data, yet it should be updated constantly. The indicator has the determining role in assessing the profitability and prospects of the project. The indicator has high volatility, short-term forecasts for 2019 vary significantly from 58 to 70 doll./bar. Long-term forecasts values diverge from 55 to 81 doll./bar.
Climatic and geological	Availability of significant oil and gas reserves; possibility of year-round oil production and transportation of hydrocarbons from the field	Climatic and geological factors are inherent to a particular field. Complexity of geological conditions of a particular field determines extraction technologies and possibility of successful development of the field. Most of the waters of the Arctic ocean are explored less than 3%, Barents and Kara seas — from 3% to 25% [11]. At present large investment in geological exploration are being made. Growth in oil reserves on the Arctic shelf in 2014 amounted to 14 million tons, gas reserves from 2011 to 2015 — 69, 170, 472, 92, and 46 billion m ³ respectively [11]. Gazprom expects gas reserves growth in the Kara sea by more than 1 trillion m ³ in 2018–2021.
Infrastructure	Investment in infrastructure construction on the part of all stakeholders ensure project profitability	Level of development of the region in terms of infrastructure directly affects the profitability of the project [12]. State support and foreign investment in infrastructure construction are vital for the project. Construction of infrastructure makes sense only if there are significant reserves in the region of production.
Technologies	Possibility of the development of domestic technologies and cooperation with foreign companies	Technologies vary according to climatic and geological conditions of each particular field. Availability of technologies necessary to develop each particular field will determine the prospects of the project. Nowadays international cooperation in terms of technologies is vital for most Arctic offshore projects. In the long term, much will depend on the extent to which the technology of offshore oil and gas production in the Arctic will develop within the country. Indicators showing company's innovative capacity cannot clearly indicate the success of the project which it develops.
Environmental Safety	Availability of environmentally-friendly extraction technologies for the country and oil and gas company	The availability of eco-technologies which allow drilling and extraction on the Arctic shelf will play a determining role in the project's prospects and prevent obstacles from international ecological organizations and standard committees. Gazprom and Rosneft are implementing a biodiversity conservation programs and environmental monitoring on the shelf. "Gazprom Neft shelf" has certificates of conformity of environmental management systems to ISO 14001 [13,14].

by the experts during Step 3. We plan two-way communication with the experts during this stage and approbation of the received results on the specific Arctic oil and gas project then.

4. Conclusions

This paper presents an algorithm of the research devoted to forecasting the prospects of Arctic offshore oil and gas project. It is based on the previously developed TESCIMP-methodology which covers the main aspects of the

development Russian Arctic offshore fields. The algorithm employs an integrated approach to the use of forecasting methods and is realized in three steps.

During step 1 of the research we propose to conduct an expert survey which will result in experts' opinions about prospects of Arctic oil and gas shelf development. Step 2 prepares an informational basis for the experts as a support in decision-making process that will be used by them on step 3. Analytical and statistical data is presented in the form of a table and corresponds to all the offshore Arctic projects. It shows the key indicators within each of TESCIMP-factors influencing project's prospects and the way they impact project's effectiveness. Step 3 involves specific expert survey which will show the influence of the specific indicators on prospects of offshore project.

Currently, general expert survey is being conducted. So, further research will focus on processing survey results and adjustment of forecasts made by different experts.

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