SPE-176694-MS

REAL OPTIONS AS A TOOL FOR ARCTIC OFFSHORE FIELDS VALUATION AND PROJECT MANAGEMENT ACCORDING IFRS 6

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This paper was prepared for presentation at SPE Russian Petroleum Technology Conference held in Moscow, Russia, 26–28 October 2015.

Abstract

Current processes of globalization and integration of the companies into the world economy necessitated the unification of financial reporting to the third parties and external users, its transparency and uniformity of financial calculations and calculation procedures.

International Financial Reporting Standards (IFRS) today play the role of a certain standard or an example of how international companies have to generate financial reports. This imposes certain obligations on the reporting procedure. Thus, on the one hand companies operate under strict rules of how and that they can be reported. On the other hand, oil and gas companies implement large risky projects, which feasibility evaluation is often difficult in the conditions of high risk and lack of the information. This situation is typical for offshore fields, particularly in the Arctic offshore, where the degree of exploration is extremely low.

The present article is concerned with the real options valuation of offshore fields in the Arctic. The main point of the article is an example of the subsequent correlation of the price value of the real options and possible costs for exploration and evaluation of the field resource potential in accordance with the principles of IFRS 6 – «Exploration for and Evaluation of Mineral Resources», an accounting standard that is core to the understanding of accounting in the mining and oil and gas industries. IFRS 6 includes modified impairment testing of exploration and evaluation assets and replaced several others international standards as IFRS 8, IFRS 16 and IFRS 36.

This approach allows us to demonstrate the applicabilityof ROV (Real Options Valuation) method and its application to offshore projects with a high degree of uncertainty, carried out at an early stage and, in particular, for the Arctic offshore projects. For illustrative purposes two possible deposits were taken on the shelf of the Barents Sea and the Kara Sea. For these two illustrative examples of the fields in the above sea waters in accordance with the climatic conditions, taking into account the current tax and investment regimes three types of option were designed: to stop the project, to delay the project and to expand the project.

The main purpose of this work is to show the applicability of various models of real options for offshore development projects through the examples in the Arctic seas at the stage of prospecting and exploration. There is also the objective to show how the techniques of project management can be agreed under the rules of reporting standards reporting for companies operating according to IFRS 6 standard.

Introduction

For the first time the activities of oil and gas companies became the object of attention of the IASB (International Accounting Standards Board) by the end of the 90s. In 2000 the Board published «The Principles of Regulations», which touched upon this subject. After that the work stopped and only in 2004 the Committee has published IFRS 6 (International Financial Reporting Standard) – «Exploration for and Evaluation of Mineral Resources». Prior before the entry into force of IFRS 6, «Exploration for and Evaluation of Mineral Resources», the reporting of oil and gas companies was limited by the application of IAS 38 and IAS 16 («Intangible assets» and «fixed assets»). Previously, International Financial Reporting Standardы did not provide for a special procedure of cost accounting in the process of exploration and appraisal work. To our opinion, there are several objective reasons for the emergence of IFRS 6:

1 The importance of the oil and gas sector for the national economies of the leading world countries attracts the attention to all speheres of the sector. In this frame IFRS 6 «Exploration for and Evaluation of Mineral Resources» may be called as the top-priority measure in addressing many issues that arise in the process of financial reporting of oil and gas companis. The whole process of analyzing many issues takes time to develop the decision and implement it. That is why the most reasonable in oil and gas accounting is to start with the most vulnerable issue for the oil and gas companies: what is the correct way to keep the rules of standards when taking into account the huge investment in prospecting and exploration works, and the main question is how to reflect in a correct way the write-down, if commercial reserves are not found.

2- In the early 2000s, large companies such as Chevron, Amoco, BP, Shell, and Santos held a large-scale statistic evaluation of the investments carried out since the 1980s. As a result, it was found that only 1% of oil and gas reserves from exploration stage turned out cost-effective, while 80% of the cost of prospecting and exploration were unprofitable in all companies. Simply put, the companies used to charge to operational costs huge exploration expenditures. Of course, this fact affected the reporting of the companies and their market value. After this research the process of risks assessment and issues of costs capitalization incurred at the exploration stage were overviewed.

3- Investments in exploration and research of new regions are directly dependent on the company's financial position, its value on the stock exchange and the possibility to attract funds, as well as it is dependent of the price of oil and gas. Therefore, it is extremely important for oil and gas companies to understand how the failure in exploration will affect the financial reporting, how dry well costs may affect the market value of the company.

Thus, when it comes to assessing the prospects for entry in the project development of the deposit, for which there is not enough number of seismological and geological data, the capital intensity of a great, the risks are quite high; companies often refuse to use many methods of project evaluation. One of these methods that are controversial about its usefulness in the oil industry is the method of real options. Non-applicability of this method is motivated by inflexibility in terms of decision making, license obligations, the risk of losing a lot of money invested in prospecting and exploration. Generally, such kind of projects includes the development of offshore fields and, in particular, the development of the Arctic shelf. In this paper we designed three real options for the project development of offshore fields in the waters of the Arctic seas: the option to continue the project (or, respectively, the stop of the project), the option to delay (in the case of the first dry well), the option for extension (if proven commercial reserves). Each option is implemented at the stage of prospecting and exploration (except for the last, which is the point of transition from the exploration stage to the production stage, but also considered at the stage of prospecting and exploration). Along with the emergence of each option shows how the cost of each step will be recorded in accordance with IFRS 6 and how the company can make decisions. The main objective of the work - to show how the decisions taken in the framework of project management, and a variety of project management tools are consistent with the requirements of financial reporting and whether it is possible or not.

SAP 24/2011 AND IFRS 6: THE SCOPE OF USE AND CONSTRAINS

Today, oil and gas companies operating in the territory of the Russian Federation usually use two main groups of standards in the preparation of statements for external users: IFRS and US GAAP. The first group has not targeted the standards regulating the activities of companies in the oil and gas production. However, there are a number of standards under which the assets and activities of the oil and gas companies are reported, as well as any other company. In view of the emergence of IFRS 6 there are following IFRS standards:

-IFRS 6 "Exploration for and Evaluation of Mineral Resources"

-IFRS 36 "Impairment of Assets"

-IFRS 37 "Backlogs, Contingent Liabilities, Contingent Assets"

-IFRS 38 "Intangible Assets"

The second group of standards is the most well developed instructions on accounting, worked out by the American Council for the FRS (Financial Accounting Standards Boards, FASB). This is due to the historical significance of the oil and gas industry in the United States and current stock exchange development. This leads to the obligation of financial reports preparation according to the rules of US GAAP (General Accepted Accounting Principles) for companies listed on American stock exchanges and therefore fall under the direct control of the USA Securities and Exchange Commission (SEC - Securities and Exchange Commission).

In addition, since 2012 all the companies in the oil and gas industry that operate mining of mineral resources (oil, gas, condensate, coal) on the territory of the Russian Federation must observe the Statements of Accounting Principles (SAP) 24/2011 - "Accounting for the cost of the exploration of mineral resources." Alike IFRS 6 «Exploration for and Evaluation of Mineral Resources», Statement of Accounting Principles 24 does not regulate the accounting of costs before the exploration for and evaluation of mineral resources, such as expenditures incurred before the entity has obtained the legal rights to explore the specific area stage and the stage of field development. The stage when the entity has obtained the license may include the following activities: geological, geophysical and geochemical, geological surveys, geological engineering, research, paleontological work and any other scientific researches.

In other words, the works in this period of exploration do not violate the integrity of the bowels. Statements of Accounting Principles (SAP) 24/2011 clearly defines the scope of its application and at the stage of exploration activity, namely the period from the date when the entity has obtained the legal rights to explore the specific area (purchase the license) and prior to the date of starting field development: "This Statements of Accounting Principles applies to entities in relation to the cost of oil and gas exploration, carried out to the point where in respect of the area, which is searched , assessment of mineral deposits and mineral exploration is finished,the technical feasibility and commercial viability of extracting a mineral resource are demonstrable, installed and documented the probability (more likely than not) that the economic benefits of mining operations will exceed the costs incurred in conditions that the company has all needed resources to extract the mineral resources (hereinafter - the commercial viability of extracting). "

Standards and substandards of international standards of accounting (IFRS) and US GAAP are shown in Fig.1. It is also remarkable the interpretation of probability in SAP 24 and IFRS 6. The term "probability more likely to be confirmed, than not" can be understood as more than 50% probability of discovery of commercial reserves. This term is very similar to the definition according to the PRMS classification of reserves. In this case, under this definition are the proven reserves and the probable reserves that just included in the balance sheet under IFRS and GAAP (P2 = Proved + Possible Reserves). Nevertheless, the question remains open about the allocation of costs to assess the technical and economic feasibility of the project prior to the acquisition of the license and when the standards allow the assignment of such assets. In this paper we consider the area of IFRS and, accordingly, SAP 24, because in many ways they are similar.

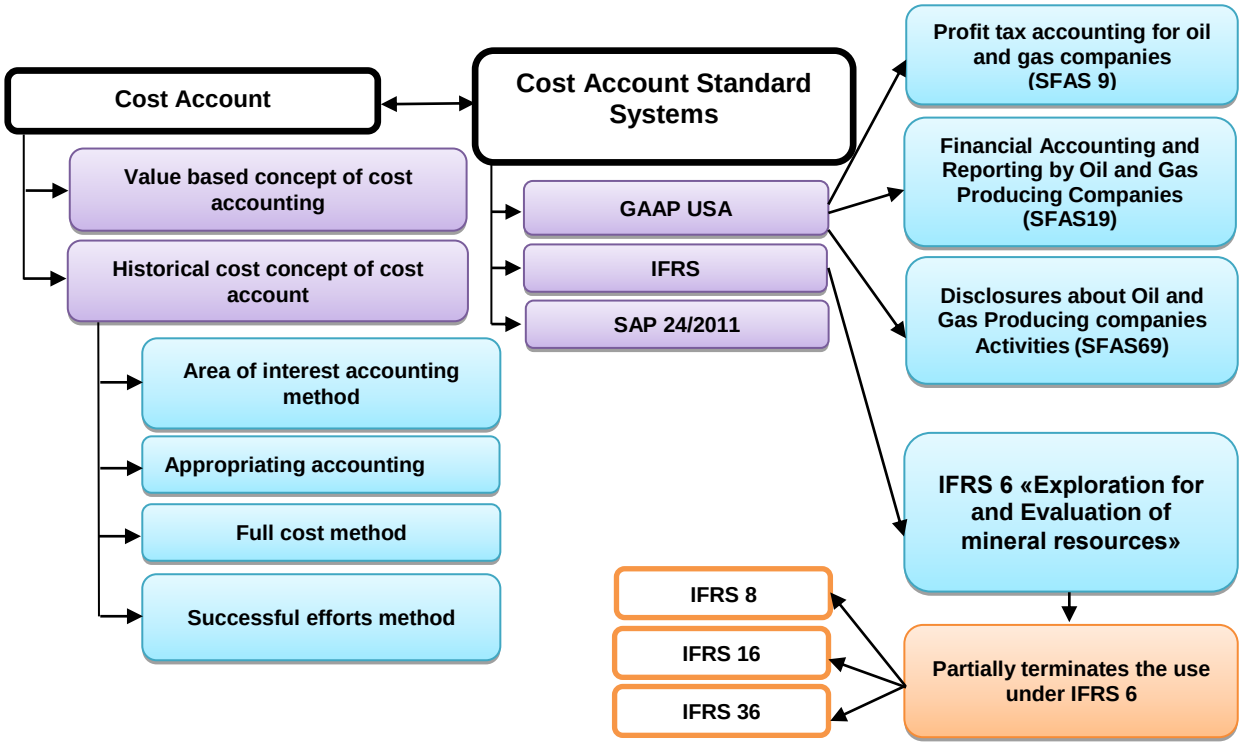


Figure 1. The scheme of cost accounting according to IFRS.
Source: prepared by the authors.

Prior to the introduction of IFRS 6 «Exploration for and Evaluation of Mineral Resources» accounting issues were excluded from the scope of IAS 38 and the right to develop the resources and reserves were excluded from the scope of IAS 16. Accounting rules for these costs in national standards of different countries are different, but the common approach in the international financial report standards has not been developed. To our opinion there are following key principles of IFRS 6 «Exploration for and Evaluation of Mineral Resources»:

1. IFRS 6 regulates the differentiation of Exploration and Evaluation stage assets (E&E - exploration and evaluation) on tangible and intangible. In the case where it is difficult to determine the tangible or intangible asset nature, it would be very useful to determine what kind of the targeted costs create. For example, if in the process of drilling, the company recieved only the information, it is likely that the asset will be an intangible object. However, in relation to the Arctic offshore fields, where all wells are transferred into operational well fund because of their capital intensity, this case is unlikely to appear.

2. The process of selecting the method of accounting for the cost of exploration and evaluation – will it be the decommisionning of the costs or their capitalization, should reflect their attachment to specific reserves.

According to that, the greater the asset is tied to the reserves, the greater the likelihood that it will be cost-based capitalization.

3. Scope of IFRS 6 «Exploration for and Evaluation of Mineral Resources» applies only to the costs of exploration implementation stage and is directly related to the search and evaluation of natural resources. Thus, the costs incurred before obtaining the license for prospecting and exploration, are excluded from the scope of IFRS 6.

In determining such kind of costs, which do not fall under the so-called concept of "assets" under IFRS, for which there is a certain probability of future economic benefits that can not be attributed to any specific stocks, the management should take professional judgment, and such costs must be expensed in the reporting period rather than capitalized.

4. The Scope of use the IFRS 6 «Exploration for and Evaluation of Mineral Resources» ends with the start of development stage.

However, IFRS 6 «Exploration for and Evaluation of Mineral Resources» does not define the concept of development stage. Earlier, the development stage in the concept of IFRS 38 was accepted when the oil field deposit development project in the context of the accounting cost was defined as the stage of the project when the found oil and (or) gas is prepared to the commercial production (pipeline to the field are being constructed at current time, the main grid of wells is drilled wells, the roads are being constructed and etc.).

In terms of IFRS 6 «Exploration for and Evaluation of Mineral Resources», the beginning of the development stage can be considered when it is clear the technical feasibility and commercial viability of extracting oil and (or) gas. In IFRS 6 the concept of development stage dffers from the concept in IFRS 38. If transfer the concept of development stage definition into PRMS classification of reserves, it is not less than 50% probability of detection and probability of proved reserves and the possibility of technical extraction with existing technologies.

In this case it is expedient development costs in the actual value of the respective objects, provided that other criteria may be included in the cost of the actual value, and when it is possible to prove that the asset will generate future economic benefits.

5. In accordance with IFRS 6, when the activity of exploration and evaluation (E&E) is stopped, the company should do the folowing:

1- terminates the capitalization of E & E expenditures
2- checks for impairment of assets
3- derecognise not impaired assets as E & E assets

The following assets may be reclassified to fixed assets (FA) or intangible assets (IA), which will be capitalized in development costs.

6. Cost Accounting FA and IA can be carried out in the model of the actual cost or the model of revalued cost. In view of the requirements for application of the model at a revalued amount, it is assumed that the actual cost of the model is more applicable for objective reasons. Firstly, for intangible assets revaluation to fair value is subject to the following conditions: objects homogeneous transactions, at any time can be found buyers, pricing information is always open. In the oil and gas industry specifics, these conditions are rarely fulfilled. Similarly, there are difficulties in determining the fair value of tangible assets, as evidence of the market value of assets in the development projects of the Arctic offshore fields may be missing due to a narrow focus and lack of analogues today.

7. In accordance with IFRS 6 in the presentation of information about impaired assets the company is guided by the IFRS36 standard. IFRS 6 assets are tested for impairment when there is evidence that the carrying amount is greater than the replacement cost. IFRS 6 includes typical for the oil and gas industry facts pointing to the need for impairment testing. For example, those can be the expiration of the license for prospecting and exploration, or the company has not found commercial reserves and decided to stop the project. The above principles of IFRS 6 on the stage before obtaining legal rights, exploration and evaluation of development are shown on the Fig. 2.

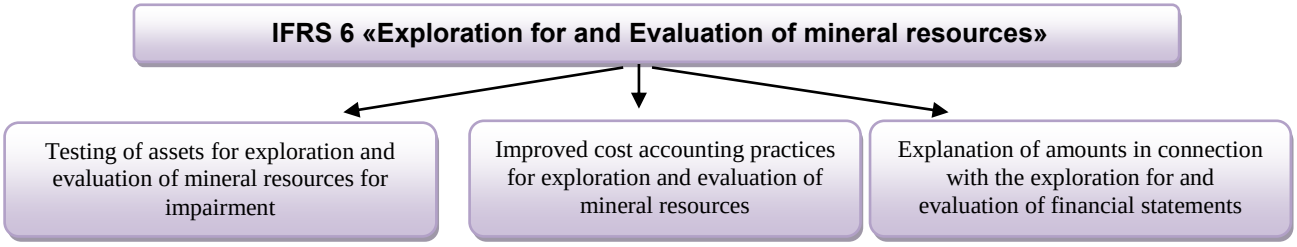


Fig.2. IFRS 6 main scope and objectives.
Source: prepared by the authors.

IFRS 6 also indicates the need for disclosure of information on the value, timing, and probability of cash flows associated with the assets. IFRS 6 determines the costs that will be capitalized in the future or will be recognized as an expense (see figure 3).

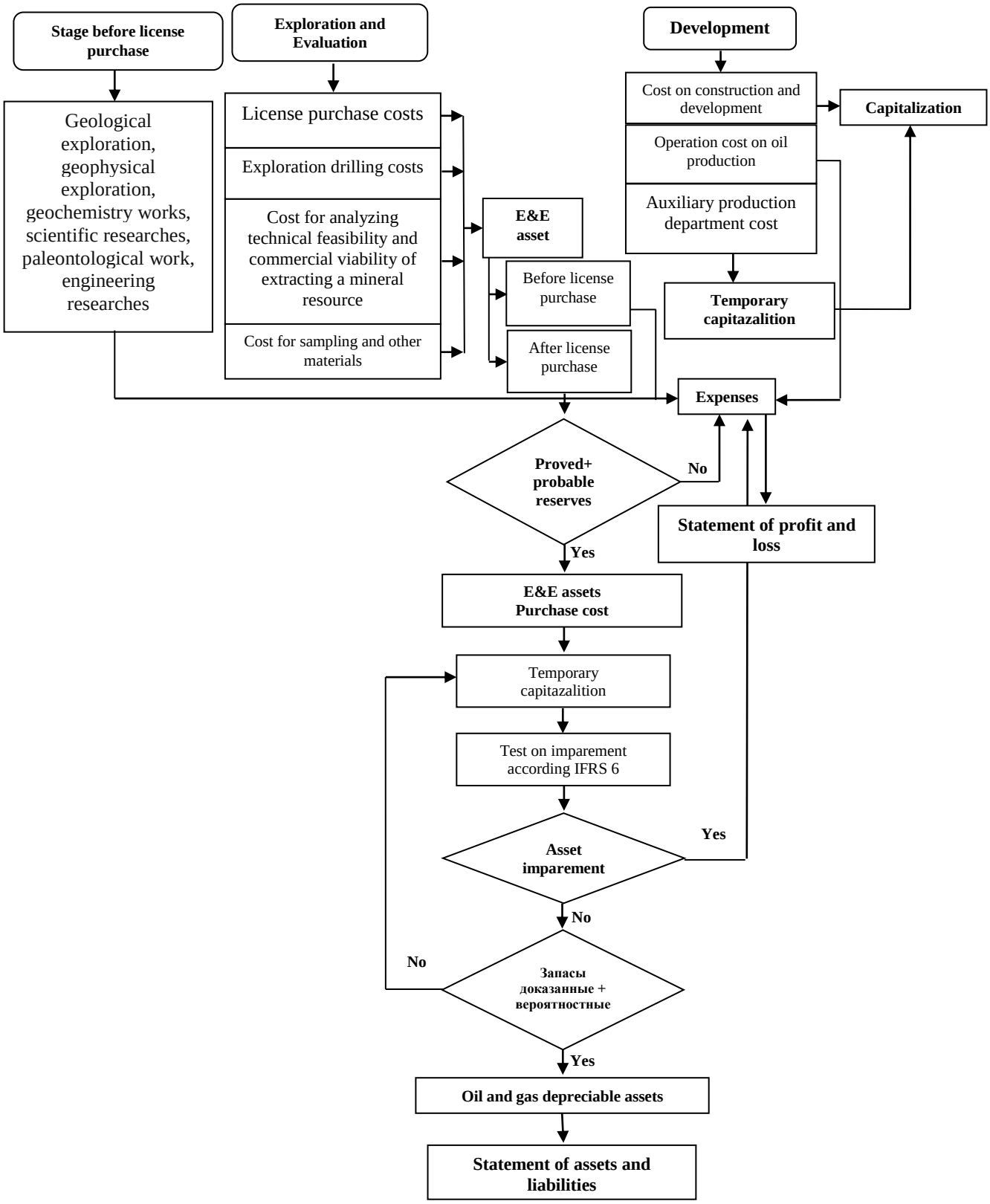


Fig. 3. The scheme of accounting at different stages of field development project.
Source: prepared by the authors.

Poject management (PM) approach and PM tools

As mentioned above, oil and gas companies now operate within the strict framework of standards on the one hand, on the other handthey realize capital-intensive and high- risk projects. In order for more effective implementation such projects oil and gas companies use widely accepted tools and methods of project management. Project Management suggests that any activity that has a beginning and an the end, can be presented as a project and divided into stages. So project is a collaborative enterprise, involving research or design that is carefully planned to achieve a particular aim.

In project management a large amount of methods and tools are used to control different parts such as costs, risks and etc. There are more than 100 different tools and instruments, the application conditions of which are not limited. Special attention is paid to the approach in risk assessment, which is especially important for offshore projects in the Arctic. The structure of the process intend that risks can be identified, measured and assessed, including the probability, possible damage and the category (low, medium, high). In the Arctic operators work in increasingly complex and not sustainable systems. Operators may blame system failures, but it is rather a trigger for occasion, than a root of the problem and much more deeper, than risk respond plan or inappropriate risk monitoring. While generally accepted RM process is appropriate for conventional projects, Arctic project operate in increasingly complicated environmental, nature, technological systems, which make them much more complex and require new processes.

In general, the complexity, the high degree of uncertainty and large investment are the current issues of project management and reporting issues to the external third parties for the following possible reasons:

1. Offshore fields require special professional approach to be developed successfully and implemented mainly according project management approach. The latter involves the use of certain techniques and tools (decision tree, complicated discounting, probabilistic modeling, real options), allowing assess the project in a correct way, to manage all the resources moving from one phase of the project to another with maximum efficiency. In terms of the company on the IFRS basis, these processes must not be contrary to the work on the preparation of financial reporting for the purpose of providing external users and attract investment.
2. Offshore fields development in the Arctic require a range of modern technologies, and Russian companies usually try to involve foreign international partners in these projects with extensive experience in the implementation of such kind of projects. Such cooperation, by definition, means the company's work on reporting not only according national but also international standards.
3. Offshore development is very capital intensive and requires large investments, hence there is a need for companies to enter the international capital markets. Listing on the international stock exchanges is impossible without the preparation of financial statements in accordance with IFRS (see. Table 1). Preparation of accounting standards in accordance with international financial reporting standards (IFRS) makes the financial statements of the company clear and transparent to foreign investors, available for a wide range of interested users, as well as independence. This requirement applies to all companies, including the oil and gas industry.
4. Oil and gas industry has a number of features. Thus, exploration accounts for a significant part of the investment. After the opening of the deposit, are not commercial at all available technologies and current prices. Exploration may not lead to the discovery of oil or gas (dry well). And as the main asset of oil companies - oil and gas reserves and the size of the required initial investment is very large, reporting increased requirements. As practice shows, the most difficult is reporting on prospecting and exploration, where national and international principles often contradict each other, and experts can have different interpretations.

The greatest difficulty in this regard to oil and gas companies are still the offshore and deep-sea fields, which in addition to the complex technical and climatic conditions, are subject to special legal and tax regimes. It is very difficult in the absence of any information to determine technical feasibility and

commercial viability of the project. As the result, the most actual in the economic development of the deposit of such a project are still questions prior to assessment of hydrocarbon resources and prospects of their development in order to decide on the acquisition of an asset (or writing off the losses in the case of not finding reserves in the license block). Companies allocate it in a separate stage of the life cycle of the field. As usual, the valuation was carried out by three main hydrocarbon methods - expensive, comparative and profitable.

Table 1. Comparison of reporting requirements in the international capital markets for oil and gas companies.

	London		Toronto		New-York		Oslo		Australia
	Main board	AIM	TSX	TSXV	NASDAQ	NYSE	OSLO BORSE	AXESS	ASX
Minimum rate of distribute shares	+	-	+	+	+	+	+	+	+
Financial statement for the past 3 years with audit report	+	+	+	+	+	+	+		+
Independent assessor report of mineral resources	+	+	+	+	+	+	+	+	+
Quarter FS	-	-	+	+	+	+	+	+	-
Claims on adequacy of operating capital	+	+	+	+	-	-	+	+	+

Source: prepared by the author basing on PwC market Report.

In practice, the use of the comparative method for the assessment of the oil and gas resources on the continental shelf (or in the Arctic shelf) is practically impossible due to their uniqueness. The use of the cost approach involves objective difficulties in determining the recoverable costs and the cost of providing equivalent utility as to determine the estimated replacement cost of the object in terms of its uniqueness, as well as the reproduction of the hydrocarbon subsoil meaningless by default. One of the tools of project management in order to determine the cost of the project in the early stages is the real options method. It allows us to estimate the possible future benefits of the project, when the standard valuation models (DCF method) lead to negative results. Real options method is in some sense the insurance of capital investment projects. Being taken from the financial sector, the real options model is a modified formula for the cost of the financial option (Black-Scholes model). The basic premise to make real use of this method is the uncertainty and the dependence of the cash flows generated by the project on the professional judgment of decision makers. The possibility of quantifying the cost of stopping the project, its expansion or switch to another market, makes it more valuable and requires managerial flexibility. Therefore, the method of real options based on the fact that any investment opportunity may be an option, but the company has no obligation to, but the right in the future to create assets or stop the project. As part of the project cost option theory NPV is the sum of the expected value of traditional NPV of the project and an additional optional cost of the project:

$$NPV(rov)= NPV + \text{option price} \quad (1)$$

Development of option theory has led to various modifications of the original model, each of which has its own field of application: 1 Black-Scholes model (option to expand the scope of the project or waive); 2- Black model (option to switch to another project after the receipt of new information); 3 model Cox-Ross-Rubinstein(CRR model) (option to delay the project); 4 model Whaley (option to expand the project); 5 – Model of Garman Kohlhagen (option on expansion of the company with a stable income); 6

- Merton model (option on the reduction of the project). To construct a model of the real option there is a need for each project to identify a number of features that is specific to it parameters (expansion project, the stop date of the project, the output from the project, and so on). For projects of development of oil and gas fields in this case one of the options is the value of resources, as the basic asset. For the distribution of reserves and future expected cash flows for the fields the assumption that they change in time with the lognormal distribution is made. Evaluation of the volatility of the project cost substitute standard deviation price of the basic asset. The cost of the option determines the amount of the cost of the investor. For risk-free rate of interest usually rate on government bonds is taken.

It should be also taken into consideration that in one project may contain multiple real options that influence each other, as well as the possibility of multiple basic asset, when there are several sources of uncertainty. With regard to the classification parameters according to IFRS, it is precisely that the costs would eventually show actual results. Since the criteria for the classification of expenses for evaluation and exploration of oil and gas as an asset of the company are not regulated, they should be developed in the company.

So, as the criteria for recognition under IFRS 6 may be the following: direct association with oil and gas exploration; it is probable that the economic benefits is associated with the object of expenditures; availability of reliable measurement of the cost or valuation. The costs incurred by the company before the start of exploration operations, usually recognized as operating expenses of the company, because at this stage reserves potential is hypothetical and do not have a reliable estimate. Thus we come to estimate the costs of prospecting and exploration, as well as evaluating the hydrocarbon potential with the method of real options.

Since this tool is used for projects where the prospect of the traditional methods of calculation, such as the NPV is negative, it is applicable for the assessment of offshore projects. The high degree of project uncertainty makes the method of real option valuation applicable and valuable, and if the company operates in the right direction, the option to eventually bring big profits.

When calculating with the standard methods, this probability is not calculated at all, or (more often) or clipped. To assess the option to stop the field development project it is advisable to use the original Black-Scholes model, since the reduction of time intervals between the nodes decide the price change (the derivative of which is the value of the option) is minimal and of a binomial model, we obtain the Black Scholes model:

$$C(S,t) = S \times N(d_1) - K \times e^{rt} \times N(d_2) \quad (2)$$

$$\text{Где } d_1 = \frac{\ln\left(\frac{S}{K}\right) + (r + \delta^2)t}{\delta\sqrt{t}},\ d_2 = d_1 - \delta\sqrt{t}$$

C- option premium (option value, value of the project on the current stage), S- current stock price (obtained result on the exploration stage), K- option striking price (expenditures for seismic), t – time until option exercise (time of the project stage), r- risk free interest rate (rate of state bonds as an example of the country the project realized in), s – standart deviation, ln- ntural log, N – cumulative normal distribution, e- exponent.

We distinguish three key points to identify options in the draft field development:

1 - Oil and gas companies can not avoid the stage before obtaining the license, as well as uncertainty at this stage. At the stage when the license is not obtained, some work on the territory of the oil and gas fields are implemented, as well as financial, economic, marketing evaluation of future areas. The stage before official license purchase can be called decisive, as its results for the company indicates to join the project or not. All incurred at this stage the costs will have to be written off in the current expenses as incurred, as there is no probability of finding reserves.

2 - At the stage of prospecting and exploration, if you have purchased a license, there may be an option for a reprieve. Thus, during drilling exploration wells, they can be dry. In this case, it may be an

option to delay, when the company suspends drilling and makes revaluation information. In practice, each project is unique and can be a lot of options. For example, in the case of not anticipated oil and gas, there is the option of switching. The method of cost accounting company chooses its own and secures it in the accounting policy. As mentioned earlier, large companies choose the method of successful research, whereas small companies follow the full cost method.

3 - The third possible option for expansion occurs at the end of the Exploration and evaluation phase, when the company determines whether the discovered commercial reserves and whether to start commercial operation or the work have not been successful and the project must be out.

For the option to stop the proposed Black-Scholes model, described above. For the option to defer (not proven reserves after the first hole), a model of Cox-Ross-Rubinstein (binomial model options) making it an option for extension can be used Black-Scholes model or a model of Garmen- Kohlhgen. In this paper we used Black-Scholes model. The process of selecting option model is shown in Fig. 4.

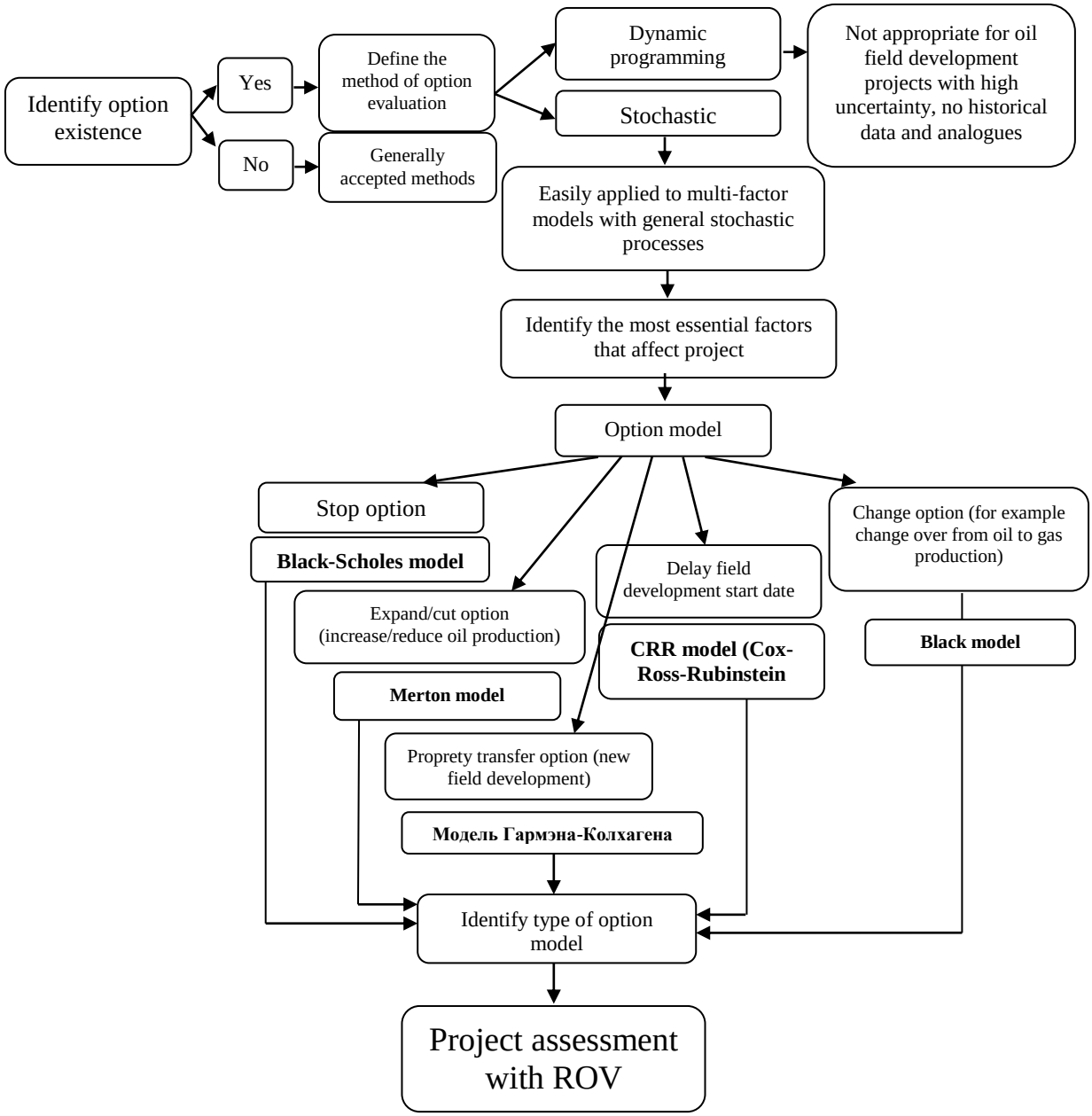


Fig. 4. The process of determining the method and option pricing model selection
Source: prepared by the authors.

Arctic offshore field development on E&E stage Real Options Valuation practice sample

As an example we considered two conditional field in the Barents Sea (A) and in the Kara Sea (B). For the analysis and evaluation of the projects a single technical and economic model was selected. It is assumed that possible reserves potential for oil and comparability of estimates for the initial prospective recoverable resources are the same. Typical structure of drilling costs for prospecting and exploration stage is shown in Fig. 5.

The choice of the location of the deposits in the Arctic and severe climatic conditions in these areas have a direct impact on the technical feasibility of the project and capital costs for exploration, which in turn is the value for the option and those costs to be taken into account. The key climatic parameters that affect the selection of the drilling rig, the cost of rental and transportation costs are shown in Table 2. According to the decree of the Government of the Russian Federation № 443-p, selected territories fall into the category of "high complexity" (A) and "Arctic complexity "(B) (sm.Ris.6). According to the decree, for the producing fields in the waters of these seas are applicable preferential rates for a specified period of MET. In the capital costs (value of the underlying asset of the option) will affect: the depth of the sea, the days of open water and distance from shore. The days of open water affect the timing of exploration, drilling costs, the duration of the works. The cost of coastal structures will be different for each project, depending on the current.

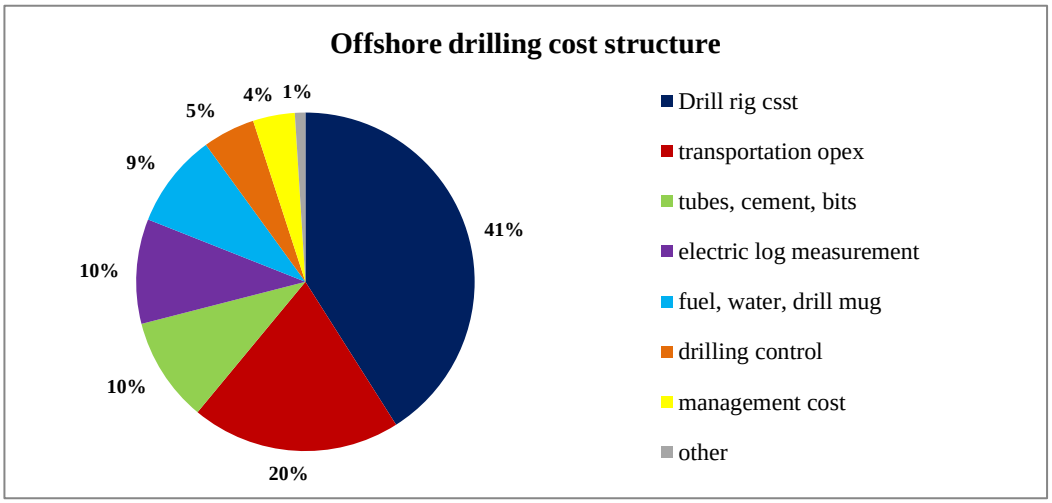


Fig. 5. Typical offshore drilling cost structure.

Source: Leamon G.R. Petroleum well costs. School of petroleum engineering The University of N.S.W.Sidney, 2006.

Table 1. Comparison of climate conditions in arctic Seas.

Parameter	The Kara Sea	The North of Barents Sea	The Pechora Sea	The Beaufort Sea
minimum temperature, t°C	-50	-35	-48	-52
w maximum wind, m/sec	40	36	41	42
wawe summit, m	5,7	10	6,2	6,3
stream velocity, m/sec	1,8-2	0,8	1	0,5
open water days	0-130	190	110	90
maximum thikness of ice without pressure ridge, m	1,8	1,8	1,3	2,1
rafting thikness, m	3,6	2	2,6	4,6-6,1

Source: S.Loeset, K.Shkhinek, O.T.Gudmestad, P.Sgrass, E.Michalenko, R.Frederkins, T.Karna. Comparison of Environmental conditions of some Arctic Seas in Basics of Offshore Petroleum Engineering and Development of Marine Facilities with Emphasis on the Arctic Offshore, Stavanger/Moscow/St.Petersburg/Trondheim, 1999.

A. Barents Sea:
Latitude 72° N: 5% MET for 15 years
Sea depth: 250 m
Open water days: 12 month
Ice thikness: icebergs
Remoteness from the Murmansk offshore: 400km

B. Kara Sea:
5% MET for 15 years
Sea depth: 70 m
Open water days: 5 month
Ice thikness:1-2m
Remoteness from the Kharasavey onshore: 300km

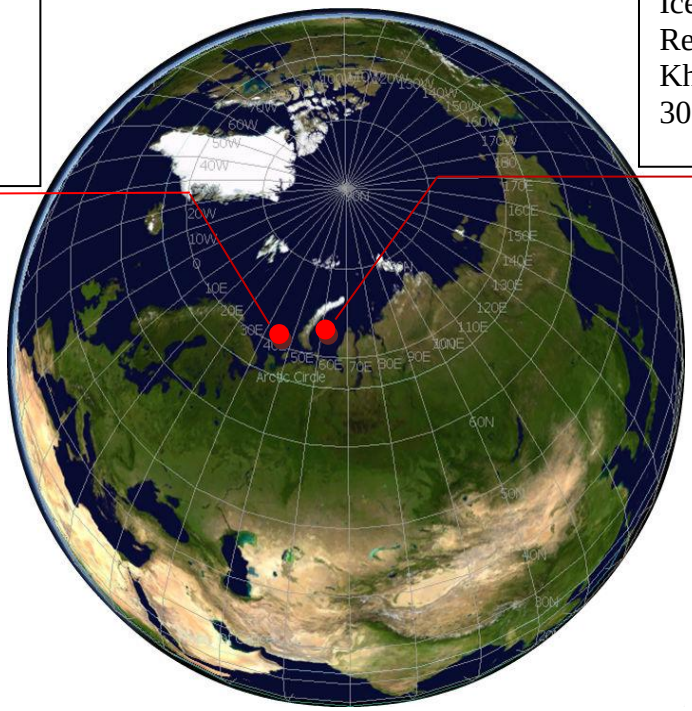


Fig. 6. Natural climatic and tax characteristics of the study area
Source: prepared by the authors.

The initial assumptions of the model:
• Assessment is based on currently available technologies for the development of offshore fields in difficult nature environments
• The tax regime used in accordance with the Decree № 443-p
• The costs for drilling according to the available information taken
• Prices are based on stocks of the 12-month average price according to the latest changes to the Commission on stocks and Exchange Commission
• geological success factor adopted by existing projects in the Barents and Kara seas (0.52).
• It is necessary to make a reservation, that in spite of the fact that the coefficient of geological success in the Kara Sea on this project = 1, we believe it is exaggerated optimistic, so in this example it is equated to success in the Barents Sea.
• Key parameters are presented in Table 3.

When assessing projects and determining the parameters of the options required value of the underlying asset. As the underlying assets are considered as stocks of oil (or gas) is necessary comparable figures that will show the value at each stage of the value of this asset. For this we offer the following indicators:

- EV (Expected Value)
- ENPV (Expected NPV)
- ATENPV (After Tax ENPV)

Table 3. Key terms for project assessment.

Parameter	Value
The average oil price over the last 12 months (at the date of writing) according to the rules determining the SEC	101$
Drilling rigs	Jackup rig for the project A (93 mmUSD/day). Jackup rig deepwater for the project B (116 mmUSD/day). [1]
Period of the project	20 years
Period of the stage before license purchase	6 months
Period of the Exploration and Evaluation stage	5 years
The number of exploration wells sequentially placed into commission	3
Expected cumulative production	300 mmbl
Number of producing well	35

Source: prepared by the author.

Real option valuation.

1. The option to stop the project at the stage before the license is purchased. At this stage it is necessary to define the parameters of the option to stop at the stage before the legal rights are obtained for the Black-Scholes model. All the options are calculated by means of stochastic modeling. The option striking price is success to be obtained in case of successful outcome. In addition to performing seismic and exploration expert opinions on the study area, the future possibilities of the project, investment and tax regimes, etc are of great importance at this stage. The key point at this stage is that all the costs incurred will not be able, even with a 10% chance to identify the perspectivness of probable reserves. Therefore, management must recognize that the inability to be connected directly to the results of this stage to the value of probable reserves, causes decommission of current expenses. The striking price of the option whose value is limited only by the probability of success equal to the costs of seismological, geological, geophysical, research and other work of this stage. Nevertheless, taking into account minimum obtained information alloes to determine the expected value of the project in the case of a successful outcome (Expected Value):

EV = (probability of success × profits in case of success) - (probability of failure × loss in case of failure) (3)

Hense, assuming that the field will be detected with probability of geological success obtained on similar ongoing projects (in practice, the company uses independently obtained geological data) and reserves of at least 250 mmbbl cost-effective (ie, to cover not only the cost of the well, but all the capital expenditures), at a cost of a stage before license purchase of not less than 100 mln., the expected value is equal to the following parameter: EV = (250 000 × 101 × 0,52) - (0,48 × 100 000) = 13,082,000 thousand dollars.

Of course, this figure does not mean that the project will bring those profits. Moreover, it is the upper limit and only suggesting the amount of probable pay off any capital expenditures in the event of success.

[1] http://www.rigzone.com/data/dayrates/ (June 2015)

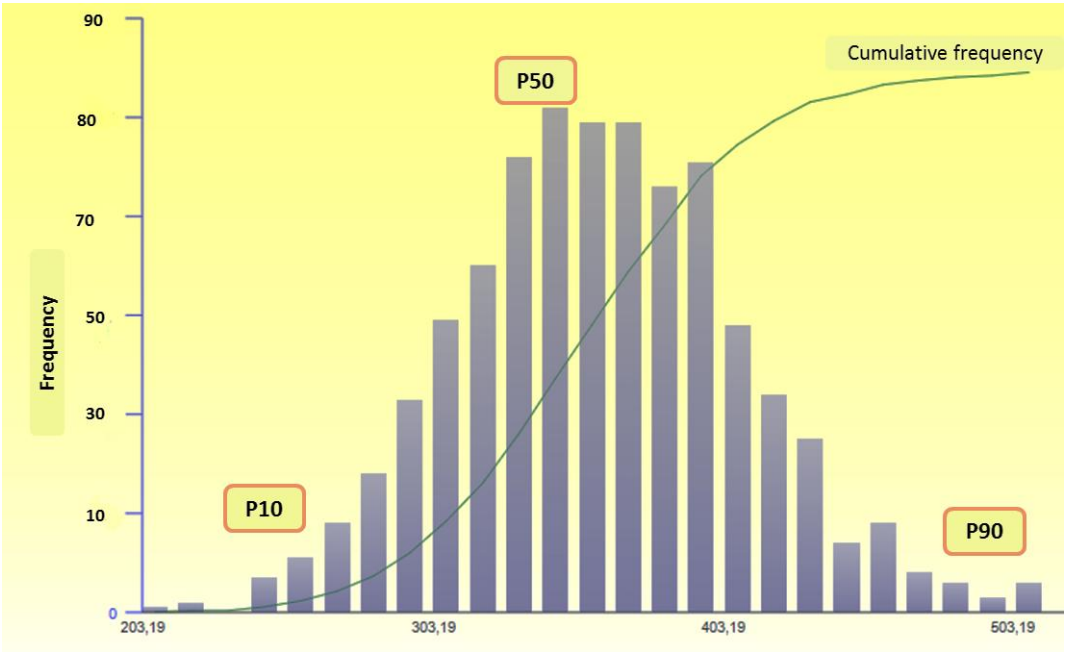
Taking into account that the capital expenditures for the project will not exceed half of the value obtained (calculation is included in the following options), and the uncertainty will decrease, the decision will cost just 100 MMUSD if successful,n other case the company will write off a loss in the current period not less than 100 MMUSD. The calculation of the option to stop the project is shown in Table 4.

Table 7. ROV parameters for stop option.

№	Parameter	Designation	A project result	B project result	Reference
1	Stop option (the stage before the rights are obtained)				
2	Option striking price	K	100 MMUSD	200 MMUSD	Seismic
3	Current stock price (basic asset)	S	13082 MMUSD	13082 MMUSD	In accordance with the possible successful of geologic exploration
4	Time until option exercise	t	6 mnth	6 mnth	Period of geologic exploration work
5	Standart deviation	δ	25%	25%	Standard deviation of reserves confirmability in the analyzed territories
6	Risk free interest rate	r			Risk free rate. Equal to the rate of state bonds.
7	Option premium	C (S,t)	13230 MMUSD	12010 MMUSD	P10 Monte Carlo simulation result

Source: prepared by the author.

At this stage, it is also possible to conduct probabilistic modeling of the distribution function of reserves to partially confirm the possibility to use the chosen coefficient success (See Fig.7)



Picture 12. EV of project success with 10 thousand Monte Carlo simulations for projects.
Source: prepared by the authors.

In the official financial statements on debit of 20 account incurred costs will come. It is assumed that the company uses in accounting policies the successful efforts method. They will not become the assets as well as they will not increase the value of the company.
Thus, the valuation prepared by options in the accounting system of the company to the external users, is likely to be $ 100 million and will be shown in the profit and loss account. The main purpose of the evaluation method of the options directly to show whether the company is now ready to show the loss at $ 100 million with 52% probability of getting no more than 13 bln.dollars from the project (the lower bound is determined and followed by an option).

2. If the company decided that the probability of success is high and allows joining in the project, then the evaluation continues. Otherwise, the result is a loss of incurred costs and the project is closed. In this paper we selected the first option. The next stage is the exploration and evaluation, which includes a sequential drilling of exploration wells. For Arctic fields exploration phase has a limited period of 5 (more than 5 years in some cases) years, and includes a number of mandatory conditions. At this stage, we see the option to reduce if the first exploration well will be dry. The reduction means that the company will review plans for the allocation of wells and grid project as a whole, because there are already some data, and there are capital costs.

If the company decides to stop the project after the first exploration well, it takes responsibility for non-compliance with license conditions and in accordance with successful cost method will have to write off costs incurred. Stopping of the project can be caused by external causes also, and when the price or market factors do not allow to develop investments in prospecting and exploration then the company is not available to keep all the license obligations. This situation is not considered in the work, but the reduction option will be the same.

Therefore, when capital costs and the emergence of the information appear, the company can calculate the expected cash flow, which is possible with a certain probability. The probability distribution for reserves and cash flow is defined lognormal. With the previous data of the geological success the model of the expected cash flow is built. Basing on the obtained result of the ENPV then by Monte Karlo simulation we calculate the probability distribution function of the expected cash flow.

ENPV = probability of commercial success × (NPV, the value of the distribution of estimated commercial reserves) - probability of business failure × (net cost if negative Geological Exploration) (4)

As it was mentioned, after the stochastic modeling of the results obtained by the Monte Carlo method (or similar, depending of type of selection of the company), the value of the option (or the underlying asset) is selected corresponding to the desired value in the range of probability.

Since one of the IFRS 6 claims is to confirm the likelihood (more likely than not) that the economic benefits of mining in the future will exceed the costs incurred, subject to technical feasibility of mining operations and that the organization has the resources needed for mining (hereinafter - the commercial feasibility of production), it is obvious that the probability range is 50% (P 50), or, for even greater certainty, 10% (P 10). The calculation of the option to reduce, if the first exploration well is dry, is presented in Table 5.

For this project, we set the condition that the first exploration well confirmed the perspectiveness of probable reserves and continued exploration drilling of two more wells, with the costs about 300 MMUSD and the probability distribution of ENPV is obtained (see Fig. 8).

Further, on the implementation phase of the project calculation of the net present value of the project after tax ATENPV is carried out. Using EV results we build a deterministic model for the first and only after that calculate stochastic distribution of ATENPV.

It is recommended to use not P50, but P10 for the avoidance of overestimating. In other words, on this stage negative result is accepted.

Table 7. ROV parameters for stop option.

№	Parameter	Designation	A project result	B project result	Reference
1	Stop option (the stage before the rights are obtained)				
2	Option striking price	K	300 MMUSD	500 MMUSD	Drilling
3	Current stock price (basic asset)	S	1693 MMUSD	302 MMUSD	In accordance with the possible successful of exploration driling
4	Time until option exercise	t	5 years	5 years	Period of geologic exploration work
5	Standart deviation	δ	25%	25%	Standard deviation of reserves confirmability in the analyzed territories
6	Risk free interest rate	r	8%	8%	Risk free rate. Equal to the rate of state bonds.
7	Option premium	C (S,t)	1750 mmUSD	543mmUSD	P10 Monte Carlo simulation result

Source: prepared by the authors.

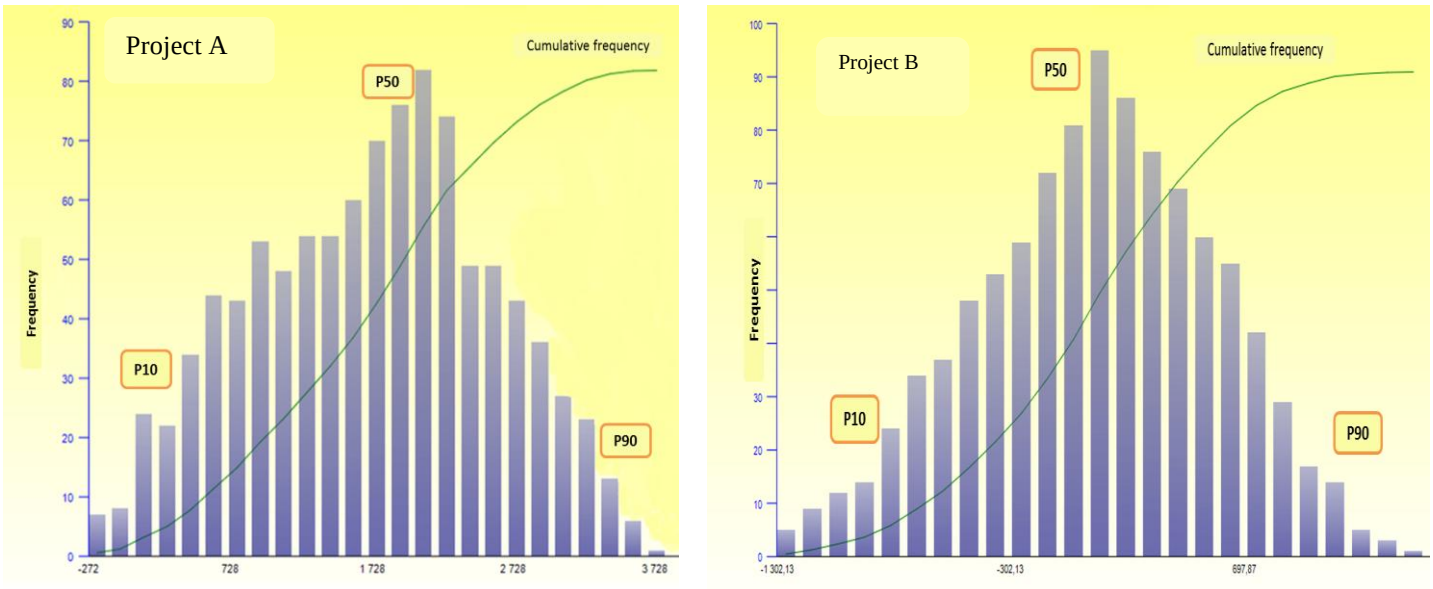


Fig.8 The probability distribution function of the calculation of the expected cash flow.
Source: prepared by the authors.

3. If the company continues prospecting and exploration (which is usually the case), the expenditure is capitalized. The successful efforts method allows you to capitalize only the portion of the cost, which is effective and yields on deposits of commercial inflows, which proved the feasibility of commercial production. This is due to the fact that the company is aware of and accepts the risks of exploration stage, as without this it is impossible to increment reserves and the creation of assets. This stage concludes with two possible outcomes: the moment of study commercial viability of extracting mineral resources or to the recognition of the production at this unpromising subsoil and the closure of the project. In the second case, the company will write off in expenses incurred costs. Thus, in the first

case, the recognition of an asset search is carried out before the commercial feasibility study. According to the method of successful efforts, costs incurred for the period, first tested on obestseennie, and then, taking into account write-down (no change or reassessment) capitalized assets.

Thus, the main objective of the company is to obtain successful results at the stage of exploration for all wells. It is therefore appropriate to consider all possible options model. Then the company will have the chance to switch on the stage of prospecting and exploration. Success of exploration will allow objectively related to assets all expenses incurred for drilling and partial field development.

Calculations show that the company is not always able to see some possibilities, and therefore to react. Real options allow to calculate all possible outcomes even at an early stage. Of course, the value of the option in the Barents sea will be higher than in the Kara. But let's not forget the amendment accounted for the success rate, it is likely that may mean greater the promising territory.

In conclusion, once again to demonstrate the accounting option value (or cost) depending on the outcome of the project. Particular attention should also be paid to the depreciation at this stage as the matter is still not well defined. Since the expected useful life of the asset at the stage of prospecting and exploration objective can be considered a time when the company is working on prospecting and exploration costs for the purchase of the license, which is not subject to amortization combined, then follow it.

The following is the procedure of impairment testing. Recorded impairment of assets similar to search markdown of fixed assets or intangible assets in accordance with SAP 6/01 and 14/2007: Debit Credit 91-2 08-10, 08-11 in the amount of write-down the actual (original) cost; Debit 02 Credit 05 91-1 in the amount of depreciation write-down (in the case of calculation and reflection using accounts 02 and 05).

In confirming the commercial viability of extracting the organization checks the search assets for impairment reflects it (with appropriate sign) and the transfer of assets to fixed assets or intangible assets at net book value. Depending on the method of reflection amortization and impairment, the accumulated amount to be written off (debit 02, 05, 06 Credit 08-10, 08-11), and the transfer of assets is reflected as follows: Debit 01 Credit 04 08-10, 08-11. In the event that production unpromising, as well as in other cases, failure to search the object to bring economic benefits in the future, its residual value is written down (Debit Credit 91-2 08-10, 08-11). This process is described in Figure 9.

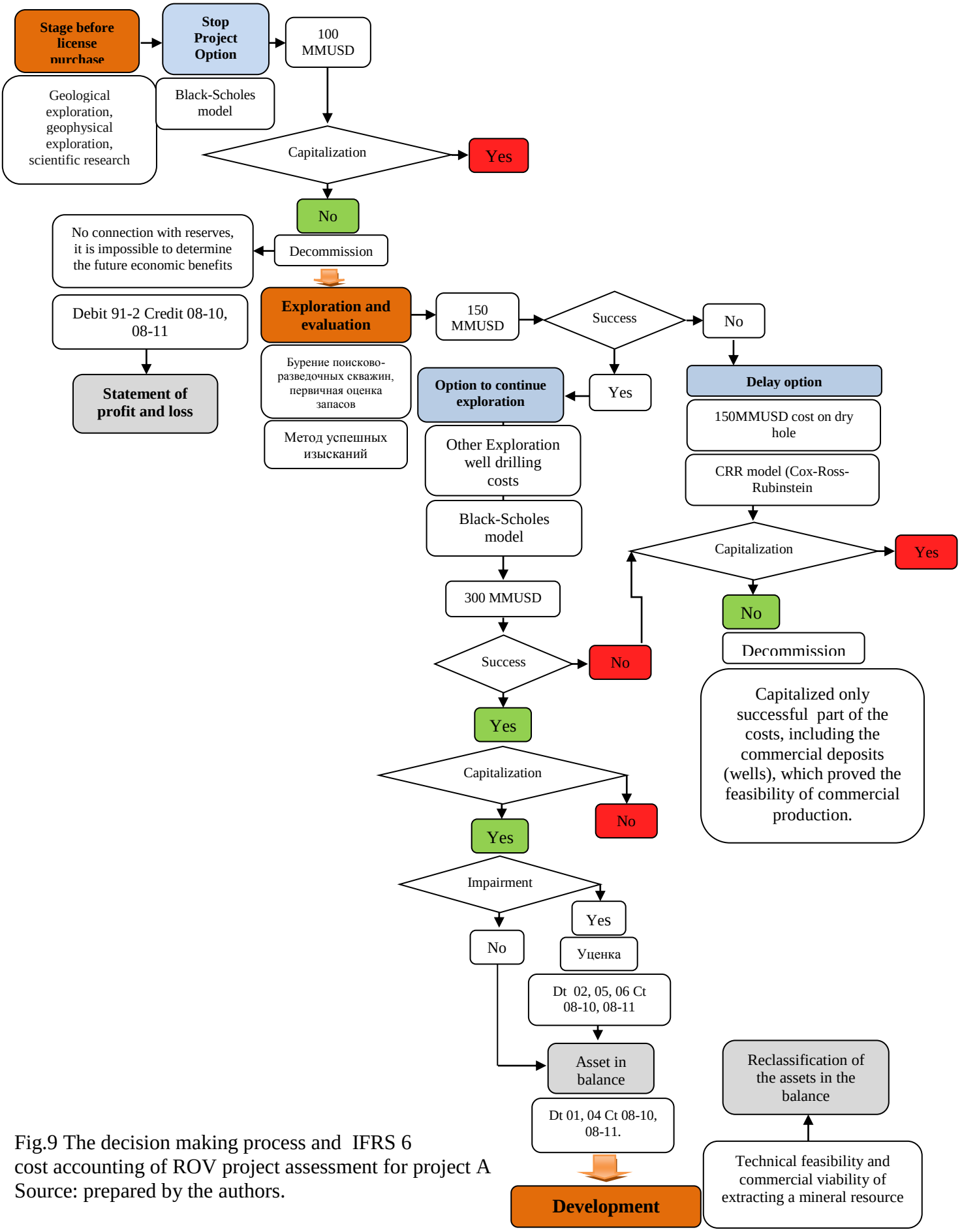


Fig.9 The decision making process and IFRS 6 cost accounting of ROV project assessment for project A
Source: prepared by the authors.

Conclusions

Future development of complex projects on the Arctic offshore requires companies not only the latest technology but also the most modern management approaches. Investment decision is the most difficult task, because in fact the company relies on expert estimates that in case of failure can not only lead to the loss of large investments, but also to the negative impact on the reputation of the company, reducing its market value on the background of criteria deteriorating.

Transparency of the activities, standardization and unification of reporting for large companies, and in particular, oil and gas entities, creates a good platform to raise funds on the one hand and, on the other hand impose big restrictions on all activities in the recognition of expenses, write-offs of or decommissioning. The adoption of IFRS 6 clearly demonstrated the beginning of large-scale and lengthy process of harmonization of standards specifically for oil and gas companies. This means that the interest in this by external institutions and third parties will be enhanced.

In such circumstances, companies should use the best practices and approaches to the evaluation of the projects of offshore fields development as the reserves are their main asset.

Referring to inflexibility in terms of decision-making, companies refuse to use applicable and effective tool for assessing the possibilities of the project.

Using different models for different possible real options company just increases the degree of their readiness for all possible outcomes, knows the value of its risks and failures. The resulting data allows a more conscious approach to decision-making. And introducing the results of its calculations to the standard reporting processes it gets visible results the company looks for external users and potential investors.

Real Options - is not the only, but one of the effective tools for decision-making in the implementation of high-risk projects in the difficult climatic conditions that the company can not only be used successfully, but also to combine with standard reporting procedures.

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