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**THE SPECIFIC CHALLENGES IN PROJECT  
MANAGEMENT FOR THE OIL AND GAS INDUSTRY**

**ОСОБЕННОСТИ УПРАВЛЕНИЯ ПРОЕКТАМИ  
В НЕФТЕГАЗОВОЙ ОТРАСЛИ**

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**Abstract.** This study is focused on the current system of project management practices by the oil and gas industry companies; the key project management principles are being reviewed from the standpoint of finding effective solutions to the issues facing operating companies of the industry. The classification of the projects is presented in terms of the investment volumes that are required to implement the projects and therefore these projects are classified as low-budget, mid-budget and big-budget projects, accordingly. The paper shows oil & gas operating company’s project risk assessment methodology using qualitative and quantitative analysis methods. The specifics of risk assessment methods are presented on the basis of simulation modeling which is the most reliable and widely used process in the oil and gas industry. To factor in the risks of potential oil pipeline failures and incidents, a methodological tool has been proposed for the model that incorporates an incident response procedure which is included into the costs incurred or mitigates the integral

effect by a discounted amount of expenses associated with the incident response operations throughout the life cycle of a facility. The above-named approaches are based on a step-by-step determination of the effectiveness by using the model in order to conduct the risk assessment of the projects. The principal advantages of the model include transparency of evaluations, simplicity of their understanding and assessment of the project performance by all participants. The process of project implementation incorporates multiple phases and that requires careful assessment of the economic efficiency of the projects. The effective project management system is therefore one of the factors contributing to successful implementation of the project and providing for further development of the industry as well. This study paper fully proves that it is expedient to apply these project management principles so to enable investments by the oil and gas operating companies and that includes the need in conducting project risk management.

**Аннотация.** Исследуется действующая система проектной деятельности компаний нефтегазовой отрасли, рассматриваются основные принципы по управлению проектами, обеспечивающих эффективное решение задач, стоящих перед компаниями отрасли. Приведена классификация проектов в зависимости от объема инвестиций, требуемых для реализации проекта, в соответствии с которой проекты классифицируются на низкобюджетные, среднебюджетные и высокобюджетные. В статье представлена методика оценки рисков проектов нефтегазовой организации по количественным и качественным методам. Отражены особенности методики оценки рисков на основе имитационного моделирования, которая является наиболее достоверной и распространённой в нефтегазовой отрасли. Для учета риска возможных отказов и аварий на нефтепроводах предложена модель, основанная на методическом подходе, которая включает методы устранения последствий аварий, входящих в состав затрат либо, снижающих интегральный эффект на дисконтированную сумму расходов по устранению последствий аварий

за период эксплуатации объекта. Данные подходы базируются на пошаговом определении значения показателя эффективности за счёт использования приводимых моделей в оценке риска проектов. Основные преимущества модели заключаются в прозрачности расчетов, простоты их восприятия и оценки результатов проекта всеми участниками. Проекты проходят много этапов в процессе их реализации и подлежат тщательной оценке с позиции экономической эффективности. Эффективная система управления проектами является одним из факторов их успешной реализации и служит дальнейшему развитию отрасли. В работе доказана целесообразность применения проектного управления в реализации инвестиций нефтегазовыми предприятиями и необходимости управления рисками проектов.

**Key words:** oil and gas industry, projects, management, investments, effectiveness.

**Ключевые слова:** нефтегазовая отрасль, проекты, управление, инвестиции, эффективность.

Currently, the oil & gas industry performance is strategically important to the country in general since the proceeds generated through the industry operating companies' operations determine the revenue side of the federal budget of the nation and well-being of the country as a whole. Subsequently, the development of the oil and gas industry is of paramount importance to the country. To advance the industry development, the oil and gas equipment upgrade & enhancement projects are designed and implemented on top of the discovery, development and operation of new oilfields inclusive of introduction of state-of-the-art technologies in the oil and gas industry. A dedicated business plan is therefore made for every new project with its implementation program incorporated implying a specific project management system.

The projects undertaken by the oil & gas operating companies can be classified in accordance with the following key focus areas in the operations (figure 1):

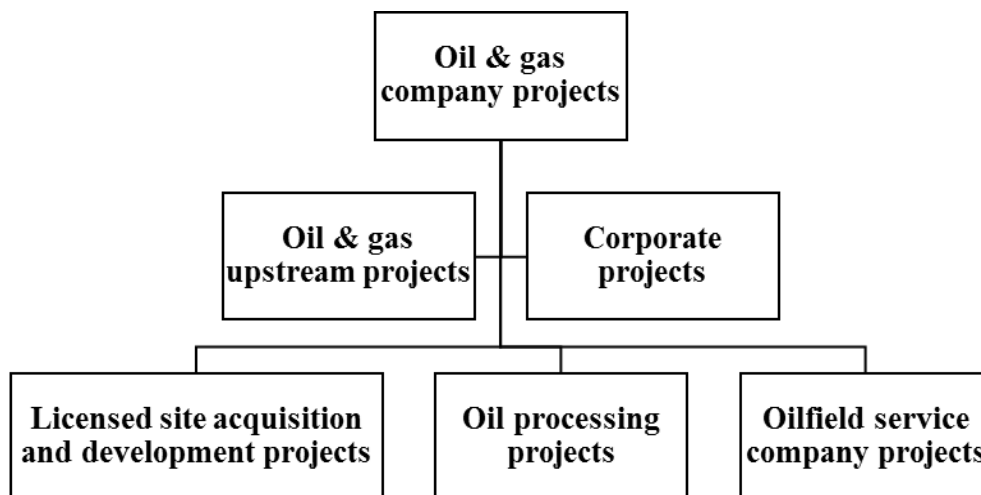


Figure 1. Oil & gas company projects

The projects undertaken by the oil & gas operating companies can also be differentiated in terms of production maintenance and development projects, purpose-wise. In this context the maintenance projects can be represented by projects designed to maintain the production rates / production operations. These projects provide for the crude oil production operations inclusive of meeting the required safety performance targets and ensure compliance with requirements of the codes and standards prescribed by the government and regulatory authorities. The business case to further develop these investment projects is built on the strength of the economic profitability.

The development projects are designed to expand and ramp up the production operations including extraction of hydrocarbons and construction of new facilities.

The business case for production maintenance projects is built on the strength of the economic profitability within the framework of the assets development project.

Projects are classified as low-budget, mid-budget and big-budget projects depending upon the amounts of investments required for their implementation.

Low-budget project is a project that requires investments in the amount up to 10 million US dollars.

Mid-budget project is a project that requires investments in the amount from 10 to 100 million US dollars.

Big-budget project is a project that requires investments in the amount exceeding 100 million US dollars.

Project manager will review the issues of project financing sources inclusive of engagement of subject matter experts and professional specialists as part of the project formulation process.

Project financing strategy implies selection of the sources of funding and its structure.

To ensure financial feasibility of the project, investments must be attracted from the capital investment sources.

Figure 2 illustrates project funding sources for the oil and gas industry.

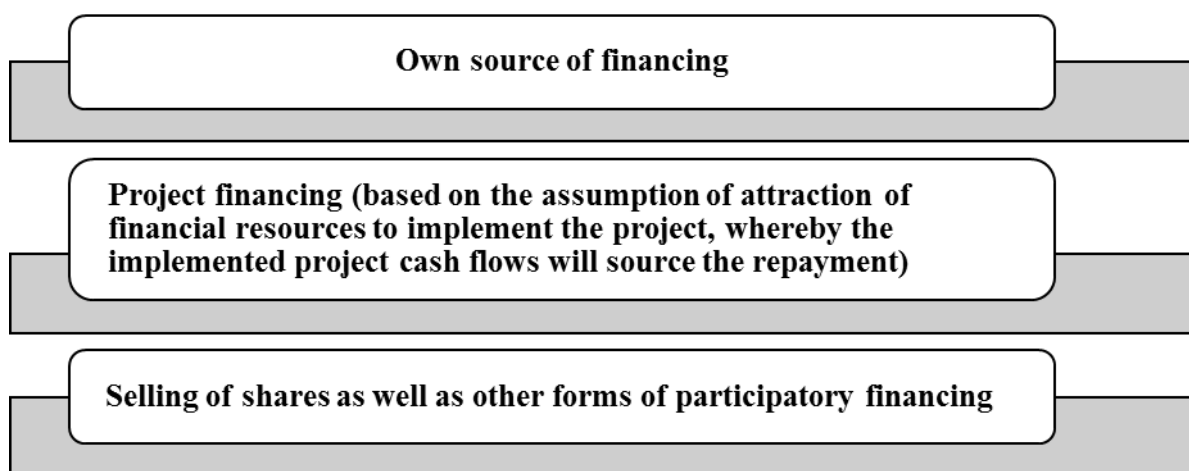


Figure 2. Project financing sources for the oil and gas industry

To facilitate the purposes of implementation of a big-budget project, funding necessary for execution of all project phases to be completed during business planning period should be included into Company's business plan. However, the available funds are limited to the amounts of an approved project phase in terms of the budget.

Project's life cycle includes the following phases.

The following processes are carried out within the framework of each phase in the process (figure 3):

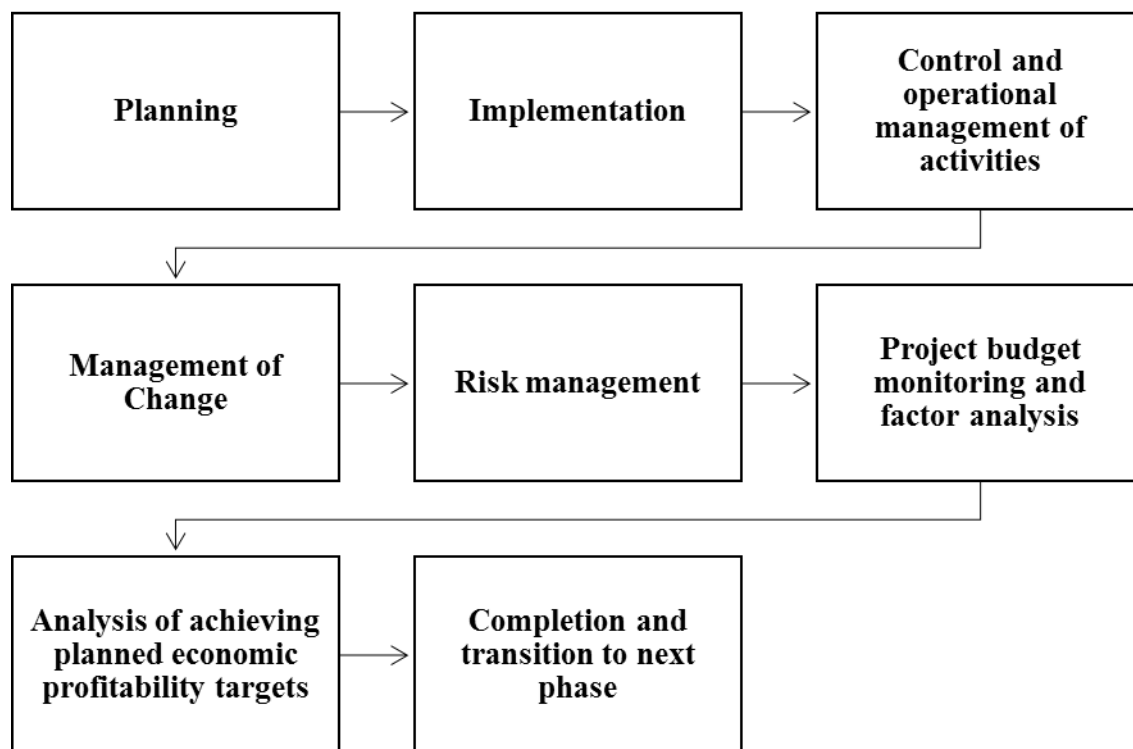


Figure 3. Project implementation processes

Project owners will kick-start project’s front-end loading activities. The purpose of the project “Initiation” stage is to review the external environment, develop business case, and consider alternatives in order to start up a new project; therefore, a preliminary assessment of potential inputs and economic benefits from the project implementation will be required.

The Assessment, Selection and Definition phases are focusing on further project development, selection of alternatives and identification of optimum strategy so that to carry out the project and that includes development of project documentation and detailed design, obtaining of approvals and permits, and having budgeting details and road map in place as well as searching for and identification of the project financing sources.

With each of the above phases completed, project manager can take a decision to transition to the next phase. A decision to move to Execution phase follows up Definition phase, when finished.

Execution phase will be implemented to create and operationally commission the production assets in accordance with the scope of work approved per the outcomes of the Definition phase. In this phase the project is handed over from project team to operating organization.

A regular monitoring is employed to exercise control of the investment project.

Project's Execution phase provides for submission of a project implementation report to project owners to enable their approval of the operational commissioning decision with regard to the asset.

Project's Execution phase implies evaluation of the effectiveness of the project performance as well as classification of the lessons learned in terms of the practices and body of knowledge gained throughout the project implementation phase. For projects moving into the Operation phase, the evaluation of project's performance by investors is a mandatory requirement.

To identify circumstances that may have negative impact on the project implementation and prior to its transition to the Operation phase during various investment project development phases, an investment project monitoring tool is applied.

The purpose of such monitoring exercise is to gain valid information on the investment project outcomes and implementation of opportunities to enable making timely and fully informed managerial decisions.

Project monitoring objectives include (figure 4):

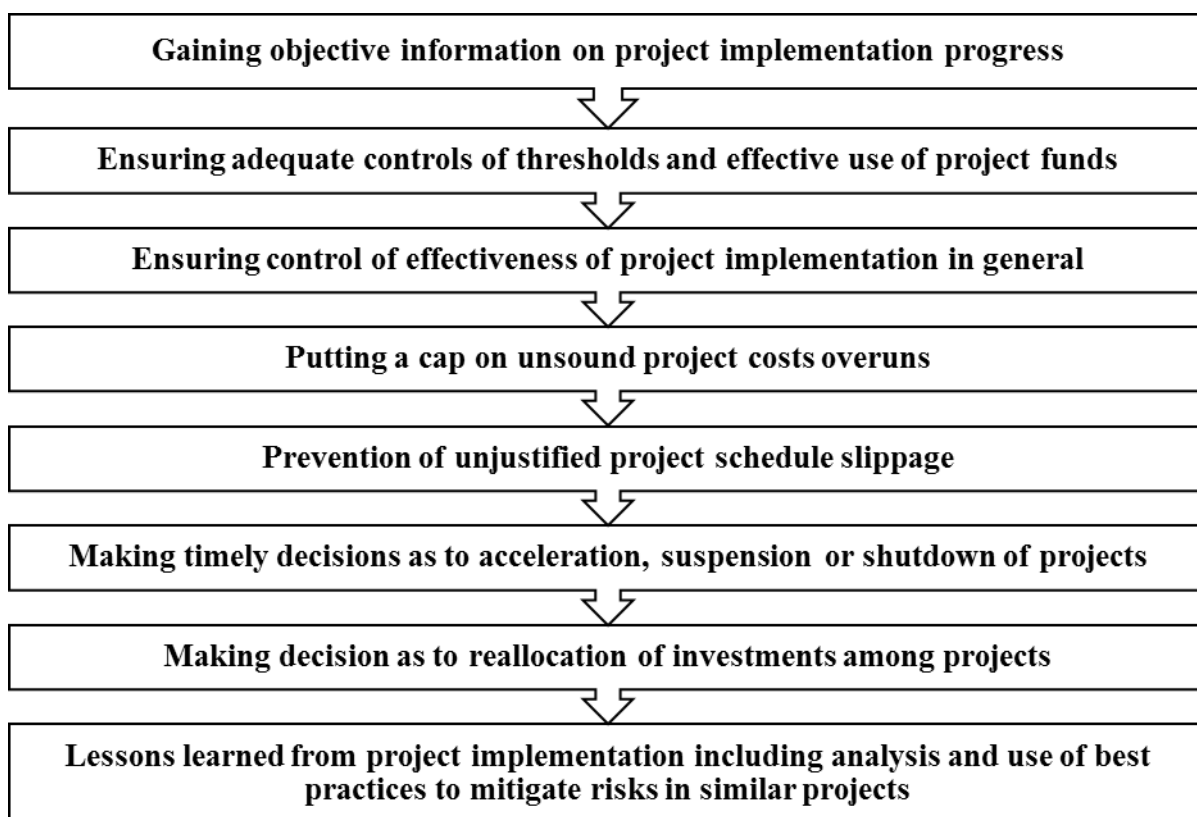


Figure 4. Project monitoring objectives

All projects must undergo continuous monitoring process.

*Project deviation significance criteria:*

- Negative production performance changes exceeding 15%;
- Any approved project budget increases;
- Changes to the project financing budget without changes in total amount of project investments.

Where such deviation does occur, it will be necessary to analyze the effects of such changes on NPV of the project. With project's NPV declining by more than 15%, the project must be resubmitted to investors to enable their decision to that effect.

- NPV changes by more than 15% due to fluctuations of macro-environment and corrections to other conditions (for instance, share of every investor in the project) as well as identification of substantial threats to the project implementation.

To select oil and gas industry projects, a system of criteria can be used as shown in table 1.



Table 1. Investment portfolio criteria for selection/inclusion of projects

Criterion	Performance target	Description
<b>1. Development projects</b>		
Conformance to strategy lines	<b>In conformance</b>	New assets projects imply conformance to the selection criteria as approved per oil & gas company's strategy framework Current assets projects are intended to deliver approved NPV within company's strategy framework.
Net Present Value (NPV)	<b>NPV &gt; 0</b>	Calculation of a project metric as per definition standard and financial and economic model updates.
Internal Rate of Return (IRR)	<b>IRR &gt; Discount rates</b>	Internal rate of return is greater than the approved rate.
Profitability Index (PI)	<b>PI &gt; 1</b>	Calculation of a project metric as per definition of standard and company's financial and economic model updates.
<b>2. Production maintenance projects</b>		
Potential losses	<b>Mitigation of operational risks</b>	High probability of causing damages to the operating process. Assessment of operating company's Lost Profit Opportunity including probability of occurrence of a risk-related incident before and after the occurrence to be considered, will provide a business case for the project.
<b>3. Projects to protect the Environment</b>		
Compliance with the regulatory authorities' requirements	<b>Compliance with standards applicable to the oil &amp; gas industry companies</b>	Projects that are carried out to comply with official citations, standards, and license obligations, requirements of technical regulations, and other mandatory requirements prescribed by controlling authorities (non-discretionary projects).
Mitigation of risks to life, health and the environment	<b>Mitigation of operational risks for the oil &amp; gas industry companies</b>	Projects that are carried out to prevent causing damages to health and the environment during company operations.

Project's potential risk assessment is an important element in risk management for the oil and gas industry.

To factor in the risks of potential oil pipeline failures and incidents, a methodological tool has been proposed for the model that incorporates an incident response procedure which is included into the costs incurred or mitigates the integral effect by a discounted amount of expenses associated with

the incident response operations throughout the life cycle of a facility (net of insurance payments).

The oil and gas industry takes the greatest risks in comparison to other sectors of the economy, the most basic one being uncertainty of exploratory drilling with yet another risk emerging more recently from periodic fluctuations of oil prices.

Figure 5 shows oil and gas industry company risks systemized.

Currently, the design institutes, construction organizations and financing institutions are being committed to deliver the most effective project solutions in terms of the construction, engineering and financial aspects driving the project.

With project effectiveness assessments confirmed, nevertheless, there can be no certainty that it will be successful. This is because actual conditions for implementation of projects are going to be different from the front-end loading project estimates, i.e. under conditions of uncertainty.

Table 2 illustrates basic uncertainty factors and sources including associated types of risks.

Table 2. Uncertainty factors and sources [5]

<b>Factors of uncertainty</b>	<b>Sources of uncertainty</b>	<b>Types of risks</b>
Technical and technological	<ul style="list-style-type: none"> <li>- Design capacity miscalculation</li> <li>- Design errors</li> </ul>	<ul style="list-style-type: none"> <li>- Escalation of the construction costs</li> <li>- Design capacity schedule failure</li> </ul>
Marketing	<ul style="list-style-type: none"> <li>- Wrongful selection of market for products</li> </ul>	<ul style="list-style-type: none"> <li>- Inability to sell products at selling price</li> </ul>
Financial	<ul style="list-style-type: none"> <li>- Currency exchange rate fluctuations</li> </ul>	<ul style="list-style-type: none"> <li>- Construction contract cost and price escalation</li> </ul>
Military and political	<ul style="list-style-type: none"> <li>- Changes of trade and political regime</li> </ul>	<ul style="list-style-type: none"> <li>- Investment cost escalation</li> <li>- Loss of project</li> </ul>
Legal	<ul style="list-style-type: none"> <li>- Incorrect formulation of documents</li> </ul>	<ul style="list-style-type: none"> <li>- Loss of property title to the project</li> </ul>
Specific risks	<ul style="list-style-type: none"> <li>- Selection of wrong pricing policy</li> </ul>	<ul style="list-style-type: none"> <li>- Inability to sell products according to schedule and at offered price</li> </ul>
Circumstantial risks	<ul style="list-style-type: none"> <li>- Man-induced disasters and catastrophes</li> </ul>	<ul style="list-style-type: none"> <li>- Incremental growth of investment costs and operating expenses</li> </ul>

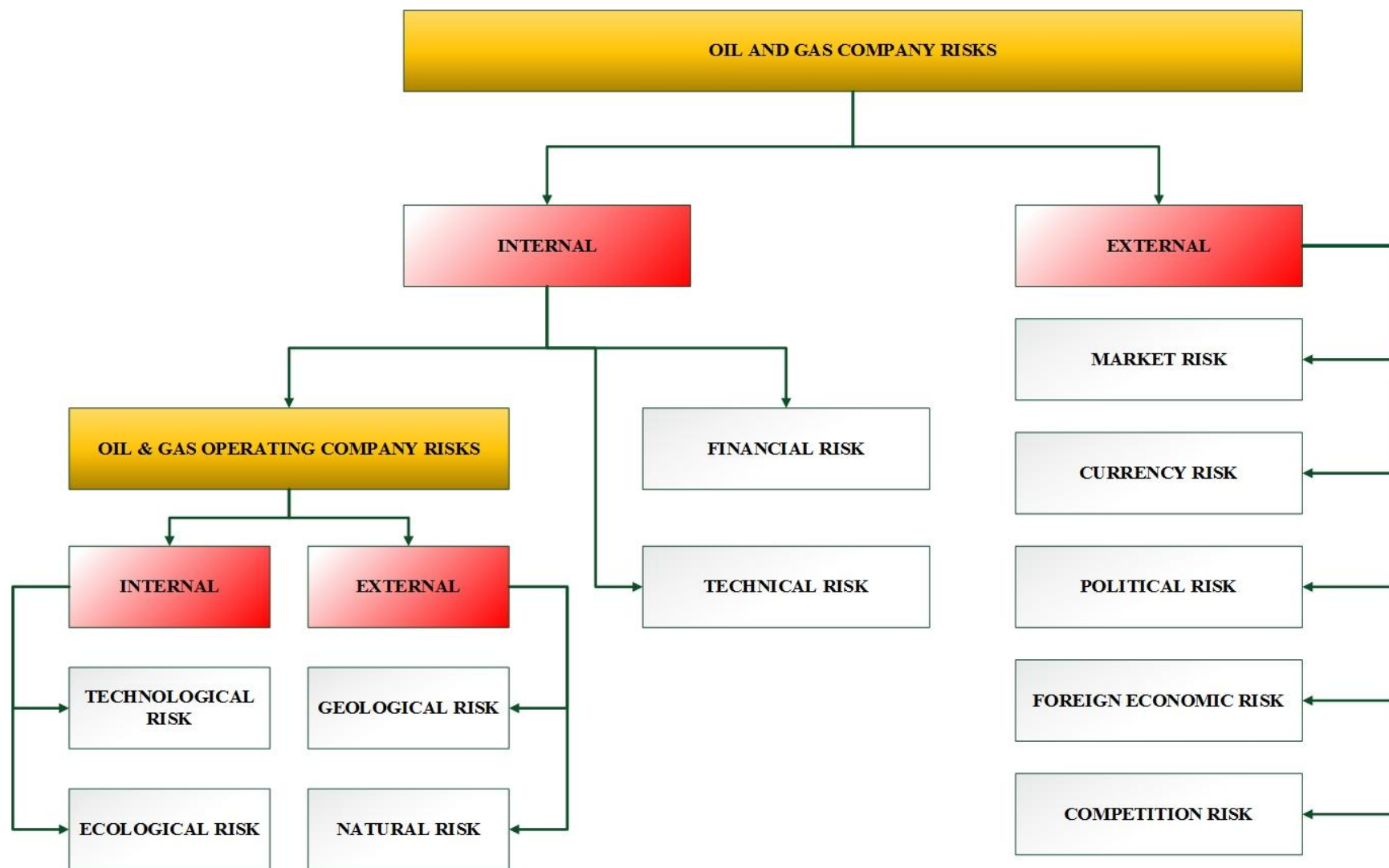


Figure 5. Oil and gas company's risks [3]

Uncertainty means incomplete and inaccurate information about the internal and external conditions for implementation of the project. With the project moving from one phase into another, degree of uncertainty is reduced due to clarification of baseline information required to calculate project targets including probable production rates, investments, configuration of equipment, and performance. However, it is not possible to eliminate all the risks and uncertainties.

Risk means the occurrence of potential conditions during implementation of the project that may have negative consequences for all or individual project partners [4].

The investment project development phase includes work scopes for the investor to know all risk factors that may have adverse impacts on the effectiveness of the project: threats and types of risk that occur in the process of implementation of the project. Information about the risks and the impact these risks can have on the effectiveness of the project in the early project development phases will help take preventive and mitigation measures or make a decision to shut down the project.

Figure 6 shows the investment project risk management model.

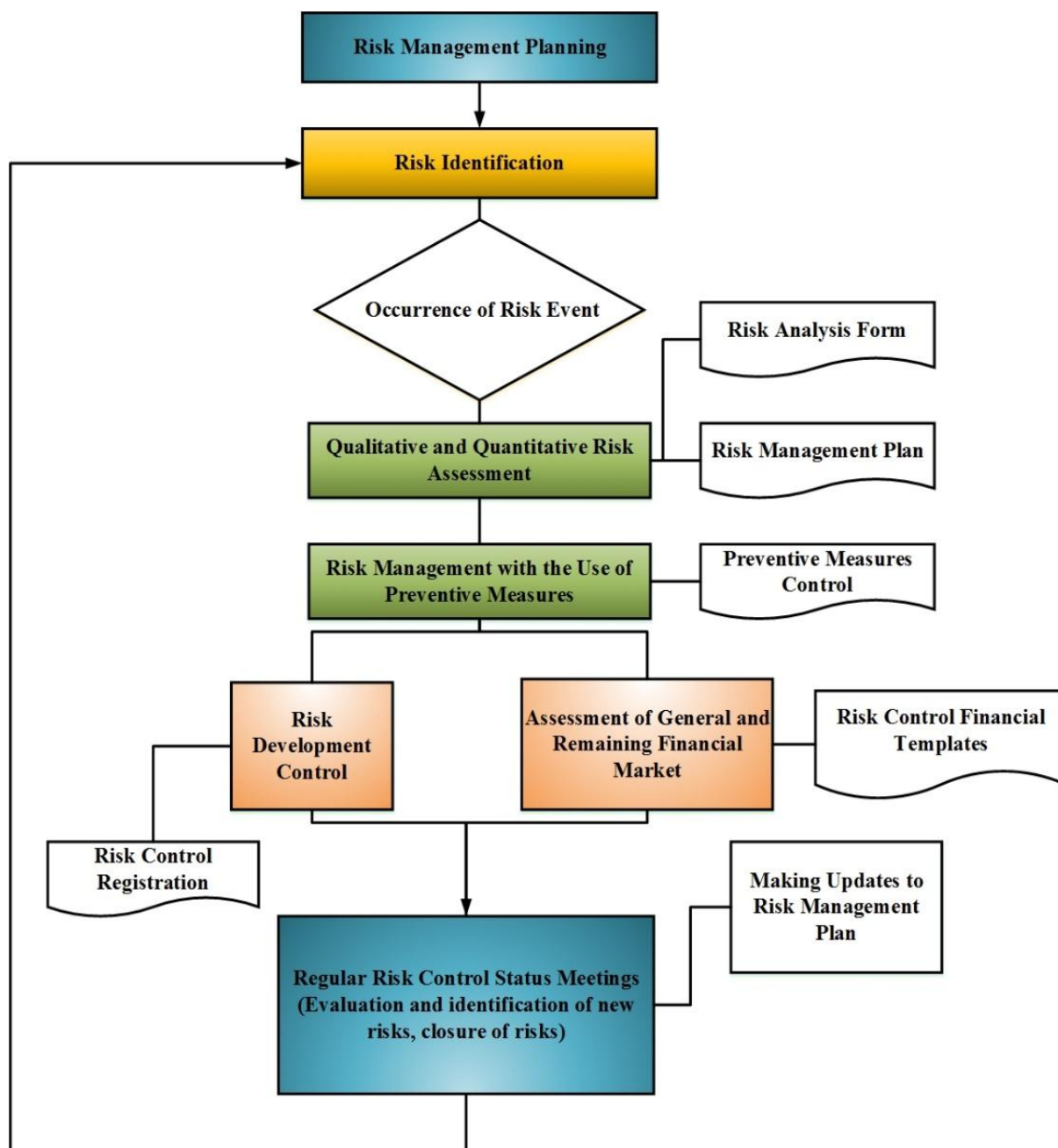


Figure 6. Risk management model [6]

The investment project risk management process is defined as a combination of risk analysis and risk management methods within the system of planning, monitoring and correction measures.

The algorithm of the investment risk assessment analysis includes two consecutive stages and which are qualitative and quantitative analysis. The primary results of qualitative risk analysis are as follows:

- Identification of project-specific types of risk inclusive of causes that may result in financial losses;

- Analysis and cost equivalent of hypothetical consequences of occurrence of potential and identified risks;

- Proposition as to taking actions to minimize the risk and select the most optimum strategy.

The primary methods of qualitative risk assessment of investment projects for the oil and gas industry are as follows:

- Expert risk assessment method;
- Risk mapping;
- Risk matrix method;
- Decision tree drafting.

Quantitative risk assessment is carried out in terms of assessment of probability that the results of project implementation will be lesser than one of the planned project parameters.

In recent years we have seen Monte Carlo simulation being increasingly used to perform quantitative risk analysis for the oil and gas industry in terms of combination of sensitivity analysis and scenario analysis. This method implies multi-step iterative methods (model calculation revisions) with random changes to initial parameters (prices and currency exchange rates) whereby risks are determined for individual project phases [2].

Such methods will often use the following algorithm:

1. Change intervals of project variables will be determined wherein they are random;
2. Types of risk probability distribution will be determined for each phase of the project;
3. Correlation factors between dependent project variables will be determined;
4. Determination of the resulting project metrics will be repeated multiple times;

5. Obtained metrics will be treated as if they were random variables corresponding to such characteristics as: mathematical expectation and distribution of probabilities;

6. Probability of occurrence of risk is determined in terms of one or another interval during implementation of the project.

Monte Carlo simulation offers a preferred approach to the evaluation of multiple and complex risk factors. Subject matter experts can independently provide their description and make a quantified assessment of risks within the area of their expertise skipping in-depth definition of general impacts on project economics. In that context, the project economics forecasts will not focus on single-point estimation of profitability of a certain oil and gas project. In contrast, they will provide project management team with a range of possible outcomes and associated probabilities. Monte Carlo simulation is focusing on estimation of project vulnerabilities versus the results of their investments with critical assumptions in their model projections factored in. This tool enables focusing financial and human resources on addressing critical tasks so to determine their perspectives in meeting the financial targets in accordance with business plans. In summary, Monte Carlo simulation is a project management tool being used to reduce risks and enhance profitability of investments.

Project profitability is determined in accordance with the following risk factors:

- Dry-hole risk. Investments into drilling operations to penetrate formations containing no gas and oil reserves;
- Drilling risk. Profitability of a project can often be nullified due to high drilling costs;
- Production risk. Notwithstanding discovery of oil and gas reserves by drilling, it is highly probable that estimation of the size of the reserves and recoverability is erroneous;
- Price risk. Product prices can vary in accordance with oil and gas industry cyclical nature;



– Political risk. Politically unstable countries control considerable amounts of reserves of hydrocarbons in the world, and corporate investments can be nationalized in these countries.

A decision to continue with further implementation of the project inclusive of its acceleration, suspension or termination is made on the basis of reports submitted to enable final project investment decision by the investors.

Therefore, project management tool is a critical component for the oil and gas industry within the framework of operating companies' investment activities.

## **Conclusions**

As these projects transition through multiple phases in the process, therefore, a thorough economic profitability assessment is required in line with the oil and gas industry project management activities.

With major oil and gas projects long-term implementation schedules taken into account, there is strong case for a high probability of negative changes to key parameters of the projects to be considered as well.

Any miscalculation with regard to the major uncertainty factors including the consequences or project risks can result in significant financial losses

To timely identify such risks and that includes the development of risk reduction and/or mitigation measures, an effective risk management model must be put in place in early project development stages as one of the key project success factors driving the development of oil and gas industry.

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