

# INTEGRATION OF RISK ASSESSMENT IN OIL AND GAS PROJECT

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## **Introduction**

Oil and Gas project is a high-risk venture. Geologically it involves the concepts of uncertainty with respect to structure, reservoir seal, and hydrocarbon charge. On the other hand, there are some uncertainties related to economic evaluation due to costs, probability of discovering and producing economically viable reservoirs and oil price. Even at the development and production stage the engineering parameters embody a high level of uncertainties in relation to their critical variables (infrastructure, production schedule, quality of oil, operational costs, reservoir characteristics, etc.). These uncertainties originated from geological models and coupled with economic and engineering models involve high-risk decision scenarios, with no guarantee of successfully discovering and developing hydrocarbons. In the oil and gas industry, managers are continuously facing important decisions regarding the allocation of scarce resources among investments that are characterized by substantial geological and financial risk and uncertainty thereby increasingly using decision analytic techniques to aid in making these decisions. The future trends in oil resources availability will depend largely on the balance between the outcomes of the cost increasing effects of depletion and the cost reducing effects of the new technology.

## **Risk assessment: field appraisal and development**

The understanding of these concepts is important to correctly investigate the best way to perform risk mitigation and to add value to exploration and production in oil and gas project. Therefore, risk analysis applied to the appraisal and development phase is a complex issue and it is no longer sufficient to quantify risk. Techniques today are pointing to

(1) quantification of value of information and flexibility, (2) optimization of production under uncertainty, (3) mitigation of risk and (4) treatment of risk as opportunity. All these issues are becoming possible due to hardware and software advances, allowing an increasing number of simulation runs of reservoir models with higher complexity (Gorell and Bassett, 2001).

## **Decision-making process, value of information and flexibility**

Making important decisions in the petroleum industry requires incorporation of major uncertainties, long time horizons, multiple alternatives, and complex value issues into the decision model. Decision analysis can be defined on different and embedded levels in oil and gas exploration and production stages. The value of information depends on both the amount of uncertainty (or the prior knowledge available) and payoffs involved in the petroleum exploration and production projects. As the level of information increases, the decision making process becomes more complex because of the necessity of (1) more accurate prediction of field performance and (2) integration with production strategy.

## **Portfolio management and the real options valuations**

Asset managers in the oil and gas industry are looking to new techniques such as portfolio management to determine the optimum diversified portfolio that will increase company value and reduce risk. A portfolio is said to be efficient if no other portfolio has more value while having less or equal risk, and if no other portfolio has less risk while having equal or greater value. The original idea states that a portfolio can be worth more or less than the sum of its component projects and there is not one best portfolio, but a collection of optimal portfolios that achieve a balance between risk and value.

## **Discussion and implications**

Decisions related to oil and gas exploration and productions are still very complex because of the high number of issues involved in the process. However, concepts of risk analysis applied to exploration, appraisal and development phases are becoming more popular as new hardware and software advances appear. New methodologies are being developed to help to mitigate risk, and this special issue is dedicated to contribute to this process.

Despite these limitations and difficulties, risk analysis has several major strengths and achievements in oil and gas exploration and production, as stated earlier. First, risk analysis provides a means for handling highly complex decisions characterized by multiple objectives and high degrees of uncertainty in diverse stages of petroleum upstream. Second, risk analysis provides an approach for dealing with complex value tradeoff and preferences of the stakeholders in the decision process in oil exploration and production. Third, risk analysis provides a systematic and comprehensive way for considering all relevant factors in a decision in the exploration and production process.