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A Methodology for Gauging the Sensitivity of Project Value during Concept Comparison and Selection

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Abstract

Project value is highly correlated with decisions made during concept comparison and selection. Decisions as such are made amid uncertainty, putting value at risk. This study details a methodology for determining the loss in project value when inaccurate estimates are used during concept comparison and selection. The difference between net present values (NPVs) based on inaccurate estimates and those based on an alternate hypothesis that is assumed to represent the truth determines the magnitude of loss. The value of the information required to reduce uncertainty can then be obtained.

An asset development optimization model is used to optimize project NPVs. The model incorporates a number of parameters and variables. Emphases are on the sensitivity of NPV to error in estimates of the statistical properties of two key input variables; initial platform cost and expansion schedule.

Results suggest poor estimates have a more marked impact on project value when the function used to describe the cost variable is *non-linear*. Results also suggest initial platform capacity tends to be too large, typically, due to the *aggressive* nature of the model when estimates of initial costs are assumed to be cheap. The model acts *conservatively* when initial costs are assumed expensive and, surprisingly, this also led to excessive initial platform capacity and loss in project value. Conservative schedule estimates also led to sub-optimal initial capacity. Generally, erred estimates of mean values are more detrimental to project value than standard deviations.

1. Introduction

Strong economic development in many parts of the world continues to increase demand for oil. Associated challenges with oil exploration and production (E&P) are far greater now than ever before. Petzet (2006) for instance states that a "sustained period of high oil and gas prices has led operators into exploration in more of the world's remote, nonproducing, and underexplored areas". In addition, increases in costs by 50% since 2003 (Barkindo, 2007), and the eventuation over the last decade of "business under-performance and unprofitable growth for many upstream companies" (Mackie, 2006) exemplify the difficulties facing E&P companies in their quests for profit.

Profit, as stated by Hillier and Lieberman (2005), is a 'payoff' that signifies a "*net monetary gain*". Net monetary gains are a function of *cash flow* and "the real measure of corporate profitability is not earnings but cash flow" (Johnston and Johnston, 2006). Like any business, E&P companies rely on *estimates* of cash flow to evaluate potential profit.

Project cash flow models developed by E&P companies rely on estimates of the statistical properties of random variables. As a result, E&P companies strive to accurately estimate the statistical properties of random variables such as *reserves*, *oil price*, *fixed and variable costs*, *inflation* and *interest rates* to provide equally accurate forecasts of project Net Present Value (NPV). Invariably, decision-makers specify random input variables by *probability distributions*. Estimates are thus made of key variable mean and standard deviations and are based, commonly, on current and projected market conditions, past experience, business intelligence, specialized software packages and the like.

Two key input variables, initial platform cost and schedule (i.e. timing of platform expansion), are central to this study. The authors do not know the true distributions for these input variables, due to uncertainty; hence they proceed to model cash flows based on inaccurate estimates.