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## Decision Making in the Oil and Gas Industry: From Blissful Ignorance to Uncertainty-Induced Confusion

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### Abstract

The battle against deterministic forecasts and financial valuations in the oil and gas industry appears to have been won, as evidenced by the plethora of papers, conference sessions, and forums focused on uncertainty quantification or profit prediction. Yet, decision makers are still not sure what they should do. Rather than basing important decisions on a single number, they now find themselves buried under a mountain of probability distributions. Uncertainty quantification seems to have confused more than it has enlightened.

In this paper, we present the findings of a survey of oil and gas professionals that addressed the following two questions: To what degree has uncertainty quantification improved in the oil and gas industry over the last five years? Has this improvement translated into improved decision making?

Uncertainty quantification is not an end unto itself; removing or even reducing uncertainty is not the goal. Rather, the objective is to make a good decision, which in many cases requires the assessment of the relevant uncertainties. The oil and gas industry seems to have lost sight of this goal in its good-faith effort to provide decision makers with a richer understanding of the possible outcomes flowing from major decisions. The industry implicitly believes that uncertainty is reduced simply by modeling it and that making good decisions merely requires more information.

To counter this, we present a decision-focused uncertainty quantification framework, which we hope, in combination with our survey results, will aid in the innovation of better decision-making tools and methodologies.

### Introduction

The use of probabilistic modeling in the oil and gas industry has increased significantly over the last 10 years, as evidenced by the large number of publications and SPE workshops and forums dedicated to the topic. For example, **TABLE 1** lists every SPE forum since 1979 that has dealt with uncertainty, prediction, or decision making.\* This information is interesting in two respects. First, six out of the eight forums have taken place in the last 10 years. Second, only one forum includes the word "decision" in the title, suggesting a strong focus by the SPE community on uncertainty quantification rather than decision making.

**TABLE 1—UNCERTAINTY- OR DECISION-FOCUSED SPE FORUMS (1979–2007)**

Year	Venue	Title
1991	Europe	Managing Uncertainties in Field Development Planning and Reservoir Modelling
1995	North America	Risk and Confidence in Reserves Valuation
1997	Asia Pacific	Risk Assessment and Management of Uncertainty
2000	North America	Risk, Options, and Portfolio Management in the Oil and Gas Business
2001	Asia Pacific	The Application of Seismic Attribute Analysis and Geostatistics in Reservoir Prediction
2002	North America	Decision-Driven Asset Development & Management
2005	Europe	Risk Management and Integrated Business Modelling
2007	North America	The Future of Profit Prediction

SPE's ATW series exhibits a similar trend, with recent meetings including "What do Geoscientists and Engineers Need to do to Better Manage Uncertainty?" (Dubrovnik, Croatia, 13–16 March 2006) and "Probabilistic Subsurface Assessments" (Houston, Texas, 18–20 July 2007).

In light of this focus on uncertainty quantification and forecasting, it seems appropriate to scrutinize its perceived value. Has this focus on uncertainty quantification and forecasting improved decision making? Which uncertainties are the most critical? Which new uncertainty-quantification methods should be developed? We set out to answer these questions through a large survey of oil and gas professionals.

The remainder of this paper is organized as follows. In the next section, we describe the survey design and

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